DEPARTMENT OF ENERGY

10 CFR Part 431

[EERE-2018-BT-STD-0003]

RIN 1904-AE42

Energy Conservation Program: Energy Conservation Standards for Variable Refrigerant Flow Multi-Split Air Conditioners and Heat Pumps

AGENCY: Office of Energy Efficiency and Renewable Energy, Department of Energy.

ACTION: Notice of proposed rulemaking and request for comment.

SUMMARY: In this document, the U.S. Department of Energy ("DOE" or the "Department") is proposing amended energy conservation standards for variable refrigerant flow (VRF) multi-split air conditioners and VRF multi-split system heat pumps (collectively referred to as "VRF multi-split systems") that rely on a new cooling efficiency metric and are equivalent to those levels specified in the industry standard. DOE has preliminarily determined that it lacks the clear and convincing evidence required by the statute to adopt standards more stringent than the levels specified in the industry standard. This document also announces a public meeting webinar to receive comment on these proposed standards and associated analyses and results.

DATES: *Comments*: DOE will accept comments, data, and information regarding this notice of proposed rulemaking (NOPR) no later than **[INSERT DATE 60 DAYS AFTER DATE OF PUBLICATION IN THE *FEDERAL REGISTER*]**. See section VII, "Public Participation," of this document for details.

Comments regarding the likely competitive impact of the proposed standard should be sent to the Department of Justice contact listed in the **ADDRESSES** section on or before [**INSERT DATE 30 DAYS AFTER DATE OF PUBLICATION IN THE *FEDERAL REGISTER***].

Meeting: DOE will hold a public meeting via webinar on Wednesday, March 23, 2022, from 1:00 p.m. to 4:00 p.m. See section VII, "Public Participation," for webinar registration information, participant instructions, and information about the capabilities available to webinar participants.

ADDRESSES: Interested persons are encouraged to submit comments using the Federal eRulemaking Portal at *www.regulations.gov*. Follow the instructions for submitting comments. Alternatively, interested persons may submit comments, identified by docket number EERE–2018–BT–STD-0003, by any of the following methods:

(1) *Federal eRulemaking Portal: www.regulations.gov. Follow the instructions for submitting comments.*

(2) *E-mail: to multisplitachp2018std0003@ee.doe.gov. Include docket number EERE–2018–BT–STD-0003 in the subject line of the message.*

No telefacsimiles (faxes) will be accepted. For detailed instructions on submitting comments and additional information on this process, see section VII of this document (Public Participation).

Although DOE has routinely accepted public comment submissions through a variety of mechanisms, including postal mail and hand delivery/courier, the Department has found it necessary to make temporary modifications to the comment submission

process in light of the ongoing corona virus (COVID-19) pandemic. DOE is currently suspending receipt of public comments via postal mail and hand delivery/courier. If a commenter finds that this change poses an undue hardship, please contact Appliance Standards Program staff at (202) 586-1445 to discuss the need for alternative arrangements. Once the COVID-19 pandemic health emergency is resolved, DOE anticipates resuming all of its regular options for public comment submission, including postal mail and hand delivery/courier.

Docket: The docket for this activity, which includes *Federal Register* notices, comments, and other supporting documents/materials, is available for review at *www.regulations.gov*. All documents in the docket are listed in the *www.regulations.gov* index. However, not all documents listed in the index may be publicly available, such as information that is exempt from public disclosure.

The docket webpage can be found at: *www.regulations.gov/#!docketDetail;D=EERE-2018-BT-STD-0003*. The docket webpage contains instructions on how to access all documents, including public comments, in the docket. See section VII (Public Participation) for information on how to submit comments through *www.regulations.gov*.

Written comments regarding the burden-hour estimates or other aspects of the collection-of-information requirements contained in this proposed rule may be submitted to Office of Energy Efficiency and Renewable Energy following the instructions at *www.RegInfo.gov*.

EPCA requires the U.S. Attorney General to provide DOE a written determination of whether the proposed standard is likely to lessen competition. The U.S. Department of

Justice (DOJ) Antitrust Division invites input from market participants and other interested persons with views on the likely competitive impact of the proposed standard. Interested persons may contact the Antitrust Division at *energy.standards@usdoj.gov* on or before the date specified in the **DATES** section. Please indicate in the "Subject" line of your email the title and Docket Number of this proposed rulemaking.

FOR FURTHER INFORMATION CONTACT: Ms. Catherine Rivest, U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, Building Technologies Office, EE-5B, 1000 Independence Avenue, SW., Washington, DC, 20585-0121. Telephone: (202) 586-7335. Email: *ApplianceStandardsQuestions@ee.doe.gov*.

Mr. Eric Stas, U.S. Department of Energy, Office of the General Counsel, GC-33, 1000 Independence Avenue, SW., Washington, D.C. 20585-0121. Telephone: (202) 586-5827. Email: *Eric.Stas@hq.doe.gov*.

For further information on how to submit a comment, review other public comments and the docket, or participate in the public meeting webinar, contact the Appliance and Equipment Standards Program staff at (202) 287-1445 or by email: *ApplianceStandardsQuestions@ee.doe.gov*.

SUPPLEMENTARY INFORMATION:

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I. Synopsis of the Proposed Rule

Title III, Part C[1] of the Energy Policy and Conservation Act, as amended (EPCA),[2] established the Energy Conservation Program for Certain Industrial Equipment. (42 U.S.C. 6311-6317) Such equipment includes small, large, and very large commercial package air conditioning and heating equipment, of which VRF multi-split systems, the subject of this rulemaking, are a category. (42 U.S.C. 6311(1)(B)-(D))

Pursuant to EPCA, DOE is required to consider amending the energy efficiency standards for certain types of covered commercial and industrial equipment, including the equipment at issue in this document, whenever the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) amends the standard levels or design requirements prescribed in ASHRAE Standard 90.1, "Energy Standard for Buildings Except Low-Rise Residential Buildings," (ASHRAE Standard 90.1), and at a minimum, every six 6 years. (42 U.S.C. 6313(a)(6)(A)-(B)) For each type of equipment, EPCA directs that if ASHRAE Standard 90.1 is amended, DOE must adopt amended energy conservation standards at the new efficiency level in ASHRAE Standard 90.1, unless clear and convincing evidence supports a determination that adoption of a more-stringent efficiency level would produce significant additional energy savings and be technologically feasible and economically justified. (42 U.S.C. 6313(a)(6)(A)(ii); referred to as the "ASHRAE trigger") If DOE adopts as a uniform national standard the efficiency level specified in the amended ASHRAE Standard 90.1, DOE must establish such standard not later than 18 months after publication of the amended industry standard. (42 U.S.C. 6313(a)(6)(A)(ii)(I)) If DOE determines that a more-stringent

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[1] For editorial reasons, upon codification in the U.S. Code, Part C was re-designated Part A-1.
[2] All references to EPCA in this document refer to the statute as amended through the Energy Act of 2020, Pub. L. 116-260 (Dec. 27, 2020).

standard is appropriate under the statutory criteria, DOE must establish such more-stringent standard not later than 30 months after publication of the revised ASHRAE Standard 90.1. (42 U.S.C. 6313(a)(6)(B)(i))

Under EPCA, DOE must also review its energy conservation standards for VRF multi-split systems every six years and either: (1) issue a notice of determination that the standards do not need to be amended, as adoption of a more-stringent level under the relevant statutory criteria is not supported by clear and convincing evidence; or (2) issue a notice of proposed rulemaking including new proposed standards based on certain criteria and procedures in subparagraph (B).[3] (42 U.S.C. 6313(a)(6)(C)(i))

ASHRAE officially released ASHRAE Standard 90.1-2016 on October 26, 2016, thereby triggering DOE's previously referenced obligations pursuant to EPCA to determine for certain classes of VRF multi-split systems, whether: (1) the amended industry standard should be adopted; or (2) clear and convincing evidence exists to justify more-stringent standard levels. For any class where DOE was not triggered, the Department routinely considers those classes under the statute's 6-year-lookback provision at the same time, so as to address the subject equipment in a comprehensive fashion.

[3] In relevant part, subparagraph (B) specifies that: (1) in making a determination of economic justification, DOE must consider, to the maximum extent practicable, the benefits and burdens of an amended standard based on the seven criteria described in EPCA; (2) DOE may not prescribe any standard that increases the energy use or decreases the energy efficiency of a covered equipment; and (3) DOE may not prescribe an amended standard that interested persons have established by a preponderance of evidence is likely to result in the unavailability in the United States of any product type (or class) of performance characteristics (including reliability, features, sizes, capacities, and volumes) that are substantially the same as those generally available in the United States. (42 U.S.C. 6313(a)(6)(B)(ii)-(iii))

The current Federal energy conservation standards for air-cooled VRF multi-split systems with cooling capacity greater than or equal to 65,000 Btu/h and water-source VRF multi-split heat pumps are codified in DOE's regulations at 10 CFR 431.97. These standards are specified in terms of Energy Efficiency Ratio (EER) for cooling mode and Coefficient of Performance (COP) for heating mode based on the Federal test procedure at 10 CFR 431.96, which references American National Standards Institute (ANSI)/Air-Conditioning, Heating, and Refrigeration Institute (AHRI) Standard 1230-2010, "*2010 Standard for Performance Rating of Variable Refrigerant Flow (VRF) Multi-Split Air-Conditioning and Heat Pump Equipment*," approved August 2, 2010 and updated by Addendum 1 in March 2011 (ANSI/AHRI 1230-2010).

The current Federal energy conservation standards for air-cooled, three-phase VRF multi-split systems with cooling capacity less than 65,000 Btu/h are also codified in 10 CFR 431.97. These standards are specified in terms of Seasonal Energy Efficiency Ratio (SEER) for cooling mode and Heating Seasonal Performance Factor (HSPF) for heating mode based on the rating conditions in ANSI/AHRI 1230-2010. Although the current standards levels are based on the same test procedure as used for all other categories of VRF systems (*i.e.,* air-cooled VRF multi-split systems with cooling capacity greater than or equal to 65,000 Btu/h and water-source VRF multi-split systems), the organizations that maintain the industry consensus test procedures have recently updated their scope such that air-cooled, three-phase VRF multi-split systems with cooling capacity less than 65,000 Btu/h are now covered under AHRI 210/240-2023 instead of AHRI 1230-2021. Consequently, DOE is addressing test procedures for air-cooled, three-phase VRF multi-split systems with cooling capacity less than 65,000 Btu/h in a separate test procedure rulemaking for air-cooled, three-phase, small commercial package air conditioning and heating equipment with cooling capacity less than 65,000 Btu/h (86

FR 70316 (Dec. 9, 2021)) instead of in the test procedure rulemaking for VRF multi-split systems (86 FR 70644 (Dec. 10, 2021)). Accordingly, DOE is not evaluating the Federal energy conservation standards for such equipment in this notice and is instead addressing energy conservation standards for air-cooled, three-phase VRF multi-split systems with cooling capacity less than 65,000 Btu/h in a separate energy conservation standards rulemaking for air-cooled, three-phase, small commercial package air conditioning and heating equipment with a cooling capacity of less than 65,000 Btu/h.

The efficiency levels set forth in ASHRAE Standard 90.1-2016 for VRF multi-split systems with cooling capacity 65,000 Btu/h or greater are specified in terms of both EER and Integrated Energy Efficiency Ratio (IEER) for cooling mode and COP for heating mode. These efficiency levels are based on the rating conditions of ANSI/AHRI Standard 1230-2014 with addendum 1 (ANSI/AHRI 1230-2014), which are identical rating conditions to those found in AHRI 1230-2010. The EER levels found in ASHRAE 90.1-2016 are unchanged from the current Federal EER requirements; however, for certain classes of water-source VRF multi-split heat pumps, the COP levels specified in ASHRAE Standard 90.1-2016 are more stringent. See additional discussion in section II.B.2 of this document.

On April 11, 2018, DOE published in the *Federal Register* a Notice of Intent to establish a negotiated rulemaking working group (Working Group) under the Appliance Standards and Rulemaking Federal Advisory Committee (ASRAC) to negotiate a proposed test procedure and amended energy conservation standards for VRF multi-split systems. 83 FR 15514. The Working Group reached consensus on an energy conservation standards term sheet (VRF ECS Term Sheet) on November 5, 2019, outlining recommended amended energy conservation standards for all equipment classes

of VRF multi-split systems. The standard levels recommended by the Working Group in the VRF ECS Term Sheet are in terms of the IEER and COP metrics and equivalent to the levels specified in ASHRAE Standard 90.1-2016.[4] However, the levels recommended by the working group are measured according to an amended industry test standard for VRF multi-split systems[5] -- AHRI Standard 1230, *"2021 Standard for Performance Rating of Variable Refrigerant Flow (VRF) Multi-Split Air-Conditioning and Heat Pump Equipment"* (AHRI 1230-2021). See additional discussion in section II.B.3 of this NOPR.

As described in detail in section III.A of this document, DOE conducted a crosswalk analysis during the ASRAC negotiation meetings to validate the translation of the EER levels currently required by the DOE standards to IEER, as well as the IEER efficiency levels as recommended by the Working Group. DOE notes that IEER is a more comprehensive metric because it reflects the energy efficiency across a range of operating conditions, as opposed to the efficiency at a single condition. The crosswalk translates the current Federal EER standards (measured per the current DOE test procedure) to IEER levels of equivalent stringency (measured per the September 20, 2019 draft version of the AHRI 1230 standard). As described in section II.B.3 of this document, the recommended 2019 draft test procedure was later published as AHRI 1230-2021, and no substantive changes were made that impact crosswalk results. Differences in the metrics and test procedures cause the crosswalk analysis to yield a range of IEER values corresponding to a given EER value. DOE's translation of the current EER levels to IEER according to the updated test procedure shows that each

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[4] The VRF ECS Term Sheet can be accessed at *www.regulations.gov/document/EERE-2018-BT-STD-0003-0055*.

[5] The VRF ASRAC Working Group recommended a 2019 draft version of AHRI 1230 with additional recommendations for further development of the test standard outside of the Working Group. The 2019 draft of AHRI 1230 was later released as AHRI 1230-2021, which included the Working Group's recommendations.

value recommended by the Working Group is within the range resulting from DOE's evaluation. Given that the metric takes into account a wider breadth of energy consumption across a variety of operating conditions, DOE has tentatively determined that the recommended IEER values are at least equivalent in stringency to the current EER values. Further, given that IEER is a more comprehensive metric, DOE has tentatively determined that the recommended IEER values would not decrease the minimum required energy efficiency of VRF basic models.

Because the updates in AHRI 1230-2021 do not affect the measurement of COP, no crosswalk was required to evaluate the stringency of the COP levels proposed in the VRF ECS Term Sheet as compared to the existing Federal COP levels.

In this document, DOE proposes to adopt the energy conservation standard levels and the equipment class structure from ASHRAE 90.1-2016 for air-cooled VRF multi-split systems with cooling capacity greater than or equal to 65,000 Btu/h and for all water-source VRF multi-split heat pumps. The proposed standards, which are expressed in terms of IEER and COP, are presented in Table I-1. These proposed standards, if adopted, would apply to all VRF multi-split systems listed in Table I-1 manufactured in, or imported into, the United States starting on January 1, 2024. The proposed standard levels are equivalent to the standard levels recommended by the Working Group in the VRF ECS Term Sheet. The proposed equipment class structure differs from the existing DOE equipment class structure regarding capacity break points and designations based on heating type; however, DOE has tentatively concluded that none of the changes to the equipment class structure for VRF multi-split systems would constitute backsliding – see section III.B of this document for additional discussion.

For the reasons described in section IV of this document, DOE has tentatively determined that the potential energy savings associated with adopting the ASHRAE 90.1-2016 standard levels for the triggered classes are *de minimis*. Also, as described in section V of this document, DOE has tentatively determined that insufficient data are available to determine, based on clear and convincing evidence, that more-stringent standards would result in significant additional energy savings and be technologically feasible and economically justified. As such DOE has not conducted further analysis of more-stringent standard levels for this rulemaking. Consequently, DOE is proposing to adopt the levels specified in ASHRAE Standard 90.1-2016, as required by EPCA.

Table I-1 Proposed Energy Conservation Standards for VRF Multi-split Systems

Equipment Type	Size Category	Heating Type	Minimum Efficiency
VRF Multi-Split Air Conditioners (Air-Cooled)	≥65,000 and <135,000 Btu/h	All	15.5 IEER
	≥135,000 and <240,000 Btu/h	All	14.9 IEER
	≥240,000 Btu/h and <760,000 Btu/h	All	13.9 IEER
VRF Multi-Split Heat Pumps (Air-Cooled)	≥65,000 and <135,000 Btu/h	Heat Pump without Heat Recovery	14.6 IEER 3.3 COP
		Heat Pump with Heat Recovery	14.4 IEER 3.3 COP
	≥135,000 and <240,000 Btu/h	Heat Pump without Heat Recovery	13.9 IEER 3.2 COP
		Heat Pump with Heat Recovery	13.7 IEER 3.2 COP
	≥240,000 Btu/h and <760,000 btu/h	Heat Pump without Heat Recovery	12.7 IEER 3.2 COP

		Heat Pump with Heat Recovery	12.5 IEER 3.2 COP
VRF Multi-Split Heat Pumps (Water-Source)	<65,000 Btu/h	Heat Pump without Heat Recovery	16.0 IEER 4.3 COP
		Heat Pump with Heat Recovery	15.8 IEER 4.3 COP
	≥65,000 and <135,000 Btu/h	Heat Pump without Heat Recovery	16.0 IEER 4.3 COP
		Heat Pump with Heat Recovery	15.8 IEER 4.3 COP
	≥135,000 and <240,000 Btu/h	Heat Pump without Heat Recovery	14.0 IEER 4.0 COP
		Heat Pump with Heat Recovery	13.8 IEER 4.0 COP
	≥240,000 Btu/h and <760,000 Btu/h	Heat Pump without Heat Recovery	12.0 IEER 3.9 COP
		Heat Pump with Heat Recovery	11.8 IEER 3.9 COP

II. Introduction

The following section briefly discusses the statutory authority underlying this proposed rule, as well as some of the relevant historical background related to the establishment of standards for VRF multi-split systems.

A. Authority

EPCA, among other things, authorizes DOE to regulate the energy efficiency of a number of consumer products and certain industrial equipment. (42 U.S.C. 6291-6317) Title III, Part C of EPCA, Pub. L. 94-163 (42 U.S.C. 6311-6317, as codified) added by Pub. L. 95-619, Title IV, section 441(a), established the Energy Conservation Program for Certain Industrial Equipment, which sets forth a variety of provisions designed to improve energy efficiency. This covered equipment includes small, large, and very large commercial package air conditioning and heating equipment, which includes the VRF multi-split systems that are the subject of this document. (42 U.S.C. 6311(1)(B)-(D)) Additionally, as discussed in further detail subsequently, the statute requires DOE to consider amending the energy efficiency standards for certain types of commercial and industrial equipment, including the equipment at issue in this document, whenever ASHRAE amends the efficiency levels or design requirements prescribed in ASHRAE Standard 90.1, and even in the absence of an ASHRAE trigger event, a separate provision of EPCA requires DOE to consider amended standards for such equipment, at a minimum, every six 6 years. (42 U.S.C. 6313(a)(6)(A)-(C))

The energy conservation program under EPCA consists essentially of four parts: (1) testing, (2) labeling, (3) the establishment of Federal energy conservation standards, and (4) certification and enforcement procedures. Relevant provisions of EPCA include definitions (42 U.S.C. 6311), energy conservation standards (42 U.S.C. 6313), test procedures (42 U.S.C. 6314), labeling provisions (42 U.S.C. 6315), and the authority to require information and reports from manufacturers (42 U.S.C. 6316).

Federal energy efficiency requirements for covered equipment established under EPCA generally supersede State laws and regulations concerning energy conservation testing, labeling, and standards. (42 U.S.C. 6316(a) and (b); 42 U.S.C. 6297) DOE may,

however, grant waivers of Federal preemption in limited circumstances for particular State laws or regulations, in accordance with the procedures and other provisions set forth under EPCA. (42 U.S.C. 6316(b)(2)(D))

Subject to certain statutory criteria and conditions, DOE is required to develop test procedures that are reasonably designed to produce test results which measure the energy efficiency, energy use, or estimated annual operating cost of covered equipment during a representative average use cycle and that are not unduly burdensome to conduct. (42 U.S.C. 6314(a)(2)) Manufacturers of covered equipment must use the Federal test procedures as the basis for: (1) certifying to DOE that their equipment complies with the applicable energy conservation standards adopted pursuant to EPCA (42 U.S.C. 6316(b); 42 U.S.C. 6296), and (2) making representations about the efficiency of that equipment (42 U.S.C. 6314(d)). Similarly, DOE uses these test procedures to determine whether the equipment complies with the relevant energy conservation standards promulgated under EPCA. The DOE test procedures for VRF multi-split systems appear at 10 CFR part 431, subpart F.

ASHRAE Standard 90.1 sets industry energy efficiency levels for small, large, and very large commercial package air-conditioning and heating equipment, packaged terminal air conditioners, packaged terminal heat pumps, warm air furnaces, packaged boilers, storage water heaters, instantaneous water heaters, and unfired hot water storage tanks (collectively referred to as "ASHRAE equipment"). For each type of listed covered equipment, EPCA directs that if ASHRAE amends ASHRAE Standard 90.1 with respect to the standard levels or design requirements applicable under that standard, DOE must adopt amended standards at the new ASHRAE efficiency levels, unless DOE determines, supported by clear and convincing evidence, that adoption of a more-stringent level

would produce significant additional conservation of energy and would be technologically feasible and economically justified. (42 U.S.C. 6313(a)(6)(A))

Although EPCA does not explicitly define the term "amended" in the context of what type of revision to ASHRAE Standard 90.1 would trigger DOE's obligation, DOE's longstanding interpretation has been that the statutory trigger is an amendment to the standard applicable to that equipment under ASHRAE Standard 90.1 that increases the energy efficiency level for that equipment. *See* 72 FR 10038, 10042 (March 7, 2007). If the revised ASHRAE Standard 90.1 leaves the energy efficiency level unchanged (or lowers the energy efficiency level), as compared to the energy efficiency level specified by the uniform national standard adopted pursuant to EPCA, regardless of the other amendments made to the ASHRAE Standard 90.1 requirement (*e.g.,* the inclusion of an additional metric), DOE has stated that it does not have the authority to conduct a rulemaking to consider a higher standard for that equipment pursuant to 42 U.S.C. 6313(a)(6)(A). *See* 74 FR 36312, 36313 (July 22, 2009) and 77 FR 28928, 28937 (May 16, 2012). If an amendment to ASHRAE Standard 90.1 changes the metric for the standard on which the Federal requirement was based, DOE would perform a crosswalk analysis to determine whether the amended metric under ASHRAE Standard 90.1 resulted in an energy efficiency level that was more stringent than the current DOE standard.

Under EPCA, DOE must also review its energy conservation standards for VRF multi-split systems every six years and either: (1) issue a notice of determination that the standards do not need to be amended, as adoption of a more-stringent level under the relevant statutory criteria is not supported by clear and convincing evidence; or (2) issue

a notice of proposed rulemaking including new proposed standards based on certain criteria and procedures in subparagraph (B).[6] (42 U.S.C. 6313(a)(6)(C)(i))

In deciding whether a more-stringent standard is economically justified, under either the provisions of 42 U.S.C. 6313(a)(6)(A) or 42 U.S.C. 6313(a)(6)(C), DOE must determine whether the benefits of the standard exceed its burdens. DOE must make this determination after receiving comments on the proposed standard, and by considering, to the maximum extent practicable, the following seven factors:

(1) The economic impact of the standard on manufacturers and consumers of the products subject to the standard;

(2) The savings in operating costs throughout the estimated average life of the covered products in the type (or class) compared to any increase in the price, initial charges, or maintenance expenses for the covered products that are likely to result from the standard;

(3) The total projected amount of energy savings likely to result directly from the standard;

[6] In relevant part, subparagraph (B) specifies that: (1) in making a determination of economic justification, DOE must consider, to the maximum extent practicable, the benefits and burdens of an amended standard based on the seven criteria described in EPCA; (2) DOE may not prescribe any standard that increases the energy use or decreases the energy efficiency of a covered equipment; and (3) DOE may not prescribe an amended standard that interested persons have established by a preponderance of evidence is likely to result in the unavailability in the United States of any product type (or class) of performance characteristics (including reliability, features, sizes, capacities, and volumes) that are substantially the same as those generally available in the United States. (42 U.S.C. 6313(a)(6)(B)(ii)-(iii))

(4) Any lessening of the utility or the performance of the covered products likely to result from the standard;

(5) The impact of any lessening of competition, as determined in writing by the Attorney General, that is likely to result from the standard;

(6) The need for national energy conservation; and

(7) Other factors the Secretary of Energy (Secretary) considers relevant.

(42 U.S.C. 6313(a)(6)(B)(i)(I)–(VII))

EPCA also contains what is known as an "anti-backsliding" provision, which prevents the Secretary from prescribing any amended standard that either increases the maximum allowable energy use or decreases the minimum required energy efficiency of a covered product. (42 U.S.C. 6313(a)(6)(B)(iii)(I))) Also, the Secretary may not prescribe an amended or new standard if interested persons have established by a preponderance of the evidence that the standard is likely to result in the unavailability in the United States in any covered product type (or class) of performance characteristics (including reliability), features, sizes, capacities, and volumes that are substantially the same as those generally available in the United States. (42 U.S.C. 6313(a)(6)(B)(iii)(II)(aa))

B. Background

1. Current Standards

EPCA defines "commercial package air conditioning and heating equipment" as air-cooled, water-cooled, evaporatively-cooled, or water-source (not including ground

water source) electrically operated, unitary central air conditioners and central air conditioning heat pumps for commercial application. (42 U.S.C. 6311(8)(A); 10 CFR 431.92) EPCA further classifies "commercial package air conditioning and heating equipment" into categories based on cooling capacity (*i.e.*, small, large, and very large categories). (42 U.S.C. 6311(8)(B)-(D); 10 CFR 431.92) "Small commercial package air conditioning and heating equipment" means equipment rated below 135,000 Btu per hour (cooling capacity). (42 U.S.C. 6311(8)(B); 10 CFR 431.92) "Large commercial package air conditioning and heating equipment" means equipment rated: (i) at or above 135,000 Btu per hour; and (ii) below 240,000 Btu per hour (cooling capacity). (42 U.S.C. 6311(8)(C); 10 CFR 431.92) "Very large commercial package air conditioning and heating equipment" means equipment rated: (i) at or above 240,000 Btu per hour; and (ii) below 760,000 Btu per hour (cooling capacity). (42 U.S.C. 6311(8)(D); 10 CFR 431.92)

Pursuant to its authority under EPCA (42 U.S.C. 6313(a)(6)(A)) and in response to updates to ASHRAE Standard 90.1, DOE has established the category of VRF multi-split systems, which meets the EPCA definition of "commercial package air conditioning and heating equipment," but which EPCA did not expressly identify. *See* 10 CFR 431.92 and 10 CFR 431.97.

DOE defines "variable refrigerant flow air conditioner" as a unit of commercial package air-conditioning and heating equipment that is configured as a split system air conditioner incorporating a single refrigerant circuit, with one or more outdoor units, at least one variable-speed compressor or an alternate compressor combination for varying the capacity of the system by three or more steps, and multiple indoor fan coil units, each of which is individually metered and individually controlled by an integral control device and common communications network and which can operate independently in response

to multiple indoor thermostats. Variable refrigerant flow implies three or more steps of capacity control on common, inter-connecting piping. 10 CFR 431.92.

DOE defines "variable refrigerant flow multi-split heat pump" as a unit of commercial package air-conditioning and heating equipment that is configured as a split system heat pump that uses reverse cycle refrigeration as its primary heating source and which may include secondary supplemental heating by means of electrical resistance, steam, hot water, or gas. The equipment incorporates a single refrigerant circuit, with one or more outdoor units, at least one variable-speed compressor or an alternate compressor combination for varying the capacity of the system by three or more steps, and multiple indoor fan coil units, each of which is individually metered and individually controlled by a control device and common communications network and which can operate independently in response to multiple indoor thermostats. Variable refrigerant flow implies three or more steps of capacity control on common, inter-connecting piping. 10 CFR 431.92.

DOE adopted energy conservation standards for VRF multi-split systems in a final rule published on May 16, 2012 (May 2012 Final Rule). 77 FR 28928, 28995. DOE's initial standards for VRF multi-split systems were prompted by ASHRAE's decision to include minimum efficiency levels for VRF multi-split systems for the first time in the 2010 edition of ASHRAE Standard 90.1 (ASHRAE Standard 90.1-2010). For four of the VRF water-source heat pump classes (including VRF water-source heat pumps with cooling capacity less than 17,000 Btu/h and VRF water-source heat pumps with cooling capacity greater than or equal to 135,000 Btu/h and less than 760,000 Btu/h), DOE adopted the standard levels in ASHRAE Standard 90.1-2010, having determined that the updates to ASHRAE Standard 90.1-2010 either raised the energy

efficiency levels above the existing Federal energy conservation standards or set standards for equipment for which DOE did not previously have standards. 77 FR 28928, 28938 (May 16, 2012). For all other equipment classes of VRF multi-split systems, DOE maintained the standards from the equipment class under which the corresponding VRF multi-split system equipment class was previously regulated (*i.e.,* air-cooled VRF multi-split systems had previously been covered as small, large, and very large air-cooled central air-conditioning heat pumps with electric resistance heating, while water-source VRF multi-split heat pumps had previously been covered as water-source heat pumps).

For the equipment addressed in this NOPR, DOE's current equipment classes for VRF multi-split systems are differentiated by refrigeration cycle (air conditioners or heat pumps), condenser heat rejection medium (air-cooled or water-source), cooling capacity, and heating type (for air-cooled: "No heating or electric resistance heating" or "all other types of heating"; for water-source: "without heat recovery," "with heat recovery," or "all"). DOE's current standards for VRF multi-split systems are set forth at Table 13 to 10 CFR 431.97 and repeated in Table II-1 of this document.

Table II-1 Current DOE Standards for VRF Multi-split Systems

Equipment type	Cooling capacity	Heating type[1]	Efficiency level	Compliance date: Products manufactured on and after . . .
VRF Multi-Split Air Conditioners (Air-Cooled)	<65,000 Btu/h	All	13.0 SEER	June 16, 2008.
	≥65,000 Btu/h and <135,000 Btu/h	No Heating or Electric Resistance Heating	11.2 EER	January 1, 2010.
		All Other Types of Heating	11.0 EER	January 1, 2010.
	≥135,000 Btu/h and	No Heating or Electric	11.0 EER	January 1, 2010.

	<240,000 Btu/h	Resistance Heating		
		All Other Types of Heating	10.8 EER	January 1, 2010.
	≥240,000 Btu/h and <760,000 Btu/h	No Heating or Electric Resistance Heating	10.0 EER	January 1, 2010.
		All Other Types of Heating	9.8 EER	January 1, 2010.
VRF Multi-Split Heat Pumps (Air-Cooled)	<65,000 Btu/h	All	13.0 SEER 7.7 HSPF	June 16, 2008.
	≥65,000 Btu/h and <135,000 Btu/h	No Heating or Electric Resistance Heating	11.0 EER 3.3 COP	January 1, 2010.
		All Other Types of Heating	10.8 EER 3.3 COP	January 1, 2010.
	≥135,000 Btu/h and <240,000 Btu/h	No Heating or Electric Resistance Heating	10.6 EER 3.2 COP	January 1, 2010.
		All Other Types of Heating	10.4 EER 3.2 COP	January 1, 2010.
	≥240,000 Btu/h and <760,000 Btu/h	No Heating or Electric Resistance Heating	9.5 EER 3.2 COP	January 1, 2010.
		All Other Types of Heating	9.3 EER 3.2 COP	January 1, 2010.
VRF Multi-Split Heat Pumps (Water-Source)	<17,000 Btu/h	Without heat recovery	12.0 EER 4.2 COP	October 29, 2012. October 29, 2003.
		With heat recovery	11.8 EER 4.2 COP	October 29, 2012. October 29, 2003.
	≥17,000 Btu/h and <65,000 Btu/h	All	12.0 EER 4.2 COP	October 29, 2003.
	≥65,000 Btu/h and <135,000 Btu/h	All	12.0 EER 4.2 COP	October 29, 2003.
	≥135,000 Btu/h and	Without heat recovery	10.0 EER 3.9 COP	October 29, 2013.

	<760,000 Btu/h	With heat recovery	9.8 EER 3.9 COP	October 29, 2013

[1] VRF Multi-Split Heat Pumps (Air-Cooled) with heat recovery fall under the category of "All Other Types of Heating" unless they also have electric resistance heating, in which case it falls under the category for "No Heating or Electric Resistance Heating."

2. ASHRAE Standard 90.1-2016

ASHRAE released the 2016 version of ASHRAE Standard 90.1 (ASHRAE Standard 90.1-2016) on October 26, 2016, which increased the heating mode efficiency level (in terms of COP) for six of the current DOE VRF multi-split system equipment classes:

(1) VRF Multi-Split Heat Pumps, Water-source <17,000 Btu/h, Without Heat Recovery;

(2) VRF Multi-Split Heat Pumps, Water-source <17,000 Btu/h, With Heat Recovery;

(3) VRF Multi-Split Heat Pumps, Water-source ≥17,000 Btu/h and <65,000 Btu/h;

(4) VRF Multi-Split Heat Pumps. Water-source ≥65,000 Btu/h and <135,000 Btu/h;

(5) VRF Multi-Split Heat Pumps, Water-source ≥ 135,000 Btu/h and <760,000 Btu/h, Without Heat Recovery; and

(6) VRF Multi-Split Heat Pumps, Water-source ≥ 135,000 Btu/h and <760,000 Btu/h, With Heat Recovery.

ASHRAE Standard 90.1-2016 left unchanged the heating mode efficiency level for the remaining six DOE equipment classes of VRF multi-split heat pump systems with cooling capacity greater than or equal to 65,000 Btu/h and left unchanged the cooling mode efficiency levels in terms of EER for all DOE equipment classes.

DOE published a notice of data availability and request for information (NODA/RFI) in response to the amendments to ASHRAE Standard 90.1-2016 in the *Federal Register* on July 8, 2019 (July 2019 NODA/RFI). 84 FR 32328. In the July 2019 NODA/RFI, DOE compared the current Federal standards for VRF multi-split systems (in terms of EER and COP) to the levels in ASHRAE Standard 90.1-2016 and requested comment on its preliminary findings. 84 FR 32328, 32333-32334 (July 8, 2019). In addition to evaluating amended energy conservation standards for the six equipment classes triggered by the updated levels in ASHRAE Standard 90.1-2016, DOE also examined the other 14 equipment classes of VRF multi-split systems under its 6-year lookback authority (42 U.S.C. 6313(a)(6)(C)) and solicited data from stakeholders. 84 FR 32328, 32334 (July 8, 2019). DOE received comments in response to the July 2019 NODA/RFI from the interested parties listed in Table II-2.

Table II-2 July 2019 NODA/RFI Written Comments

Commenter(s)	**Reference in this NOPR**	**Commenter Type**
California Investor-Owned Utilities	CA IOUs	Utilities
Air-Conditioning, Heating, & Refrigeration Institute	AHRI	Trade Association
Hydronic Industry Alliance – Commercial	HIA - C	Trade Association
Institute for Policy Integrity at NYU School of Law	Policy Integrity	Academic Institution

DOE discusses comments received in response to the July 2019 NODA/RFI in the following sections of this document. A parenthetical reference at the end of a comment quotation or paraphrase provides the location of the item in the public record.[7]

On October 24, 2019, ASHRAE officially released for distribution and made public ASHRAE Standard 90.1-2019. ASHRAE Standard 90.1-2019 maintained the equipment class structure for VRF multi-split systems from ASHRAE Standard 90.1-2016 and did not update efficiency levels for any VRF equipment classes.

3. ASRAC Negotiations

On April 11, 2018, DOE published in the *Federal Register* a notice of its intent to establish a negotiated rulemaking working group (Working Group) under the Appliance Standards and Rulemaking Federal Advisory Committee (ASRAC), in accordance with the Federal Advisory Committee Act[8] and the Negotiated Rulemaking Act,[9] to negotiate an amended test procedure and amended energy conservation standards for VRF multi-split systems. 83 FR 15514. The purpose of the Working Group was to discuss and, if possible, reach consensus on a proposed rule regarding the test procedure and energy conservation standards for VRF multi-split systems, as authorized by EPCA. *Id*. The Working Group comprised 21 voting members including manufacturers, energy efficiency advocates, utilities, and trade organizations.[10]

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[7] The parenthetical reference provides a reference for information located in the docket of DOE's rulemaking to develop energy conservation standards for VRF multi-split systems. (Docket No. EERE-2018-BT-STD-0003, which is maintained at *www.regulations.gov*). The references are arranged as follows: (commenter name, comment docket ID number, page of that document).

[8] 5 U.S.C. App. 2, Pub. L. 92-463.

[9] 5 U.S.C. 561-570, Pub. L. 101-648.

[10] A complete list of the ASRAC VRF Working Group members is available by clicking on the "Working Group" tab at: *www.energy.gov/eere/buildings/appliance-standards-and-rulemaking-federal-advisory-committee#Variable%20Refrigerant%20Flow%20Multi-Split%20Air%20Conditioners%20and%20Heat%20Pumps%20Working%20Group*.

On October 1, 2019, the Working Group reached consensus on a test procedure term sheet (VRF TP Term Sheet; Docket No. EERE-2018-BT-STD-0003-0044) that includes several recommendations. The following list includes the most substantial recommendations:

(1) VRF multi-split systems should be rated with the Integrated Energy Efficiency Ratio (IEER) metric to allow consumers to make consistent comparisons with other equipment using the IEER metric (e.g., rooftop air conditioner ratings).

(2) Use of the amended test procedure should not be required until the compliance date of amended energy conservation standards.

(3) The Federal test procedure for VRF multi-split systems should be consistent with the September 20, 2019 draft version of AHRI 1230, with additional recommended amendments to be implemented after the conclusion of ASRAC negotiations.

Following completion of the VRF TP Term Sheet, the Working Group proceeded to negotiate recommended revised energy conservation standards for VRF multi-split systems that accounted for the translation from the EER metric to the IEER metric, as well as the changes between the Federal test procedure that references AHRI 1230-2010 and the recommended 2019 draft test procedure AHRI 1230 (which was later published as AHRI 1230-2021). As described in greater detail in section III.A of this document, DOE conducted a crosswalk analysis to inform the development of standard levels for VRF multi-split systems in terms of the new test procedure and metric. DOE presented the results of its crosswalk analysis on November 5, 2019 (Docket No. EERE-2018-BT-STD-0003-0061 at p. 45), and subsequently, the Working Group reached consensus on an

energy conservation standards term sheet (VRF ECS Term Sheet; Docket No. EERE-2018-BT-STD-0003-0055) recommending:

(1) Amendments to the Federal minimum efficiency standards for VRF multi-split systems (as presented in Table II-3 of this NOPR) and per the test procedure recommended in the VRF TP Term Sheet.

(2) The compliance date of the recommended energy conservation standards should be January 1, 2024 for all VRF multi-split system equipment classes included in this proposed rulemaking.

Table II-3: Recommended Efficiency Levels from VRF ECS Term Sheet

Equipment Class	Energy Efficiency Levels Recommended[1]
VRF Air Conditioners, Air-cooled, ≥65,000 Btu/h and <135,000 Btu/h	15.5 IEER
VRF Air Conditioners, Air-cooled, ≥135,000 Btu/h and <240,000 Btu/h	14.9 IEER
VRF Air Conditioners, Air-cooled, ≥240,000 Btu/h and <760,000 Btu/h	13.9 IEER
VRF Heat Pumps, Air-cooled, ≥65,000 Btu/h and <135,000 Btu/h, No Heating or Electric Resistance Heating	14.6 IEER, 3.3 COP
VRF Heat Pumps, Air-cooled, ≥65,000 Btu/h and <135,000 Btu/h, All Other Types of Heating	14.4 IEER, 3.3 COP
VRF Heat Pumps, Air-cooled, ≥135,000 Btu/h and <240,000 Btu/h, No Heating or Electric Resistance Heating	13.9 IEER, 3.2 COP
VRF Heat Pumps, Air-cooled, ≥135,000 Btu/h and <240,000 Btu/h, All Other Types of Heating	13.7 IEER; 3.2 COP
VRF Heat Pumps, Air-cooled, ≥240,000 Btu/h and <760,000 Btu/h, No Heating or Electric Resistance Heating	12.7 IEER, 3.2 COP
VRF Heat Pumps, Air-cooled, ≥240,000 Btu/h and <760,000 Btu/h, All Other Types of Heating	12.5 IEER; 3.2 COP

Equipment Class	Energy Efficiency Levels Recommended[1]
VRF Heat Pumps, Water-source, <17,000 Btu/h, Without Heat Recovery	16.0 IEER, 4.3 COP
VRF Heat Pumps, Water-source, <17,000 Btu/h, With Heat Recovery	15.8 IEER, 4.3 COP
VRF Heat Pumps, Water-source, ≥17,000 Btu/h and <65,000 Btu/h, Without Heat Recovery	16.0 IEER, 4.3 COP
VRF Heat Pumps, Water-source, ≥17,000 Btu/h and <65,000 Btu/h, With Heat Recovery	15.8 IEER, 4.3 COP
VRF Heat Pumps, Water-source, ≥65,000 Btu/h and <135,000 Btu/h, Without Heat Recovery	16.0 IEER, 4.3 COP
VRF Heat Pumps, Water-source, ≥65,000 Btu/h and <135,000 Btu/h, With Heat Recovery	15.8 IEER, 4.3 COP
VRF Heat Pumps, Water-source, ≥135,000 Btu/h and <240,000 Btu/h, Without Heat Recovery	14.0 IEER, 4.0 COP
VRF Heat Pumps, Water-source, ≥135,000 Btu/h and <240,000 Btu/h, With Heat Recovery	13.8 IEER, 4.0 COP
VRF Heat Pumps, Water-source, ≥240,000 Btu/h and <760,000 Btu/h, Without Heat Recovery	12.0 IEER, 3.9 COP
VRF Heat Pumps, Water-source, ≥240,000 Btu/h and <760,000 Btu/h, With Heat Recovery	11.8 IEER, 3.9 COP

[1] The VRF ECS Term Sheet includes the notation "COP_H" which indicates coefficient of performance in heating mode at 47°F outdoor ambient temperature (for air-cooled VRF multi-split heat pumps) and at 68°F entering water temperature (for water-source VRF multi-split heat pumps).

DOE notes that there are minor differences in equipment class structure (related to cooling capacity, supplementary heating type, and presence of heat recovery) between the VRF ECS Term Sheet, ASHRAE Standard 90.1-2019, and the current Federal energy conservation standards for VRF multi-split systems. This topic is discussed in greater detail in section III.B of this document.

On May 18, 2021, AHRI published an updated industry test standard for VRF multi-split systems AHRI 1230-2021. Subsequently, on December 10, 2021, DOE published in the *Federal Register* the VRF TP NOPR (December 2021 VRF TP NOPR), in which DOE proposed an amended test procedure for VRF multi-split systems that incorporates by reference AHRI 1230-2021 and proposed to adopt IEER as the test metric for VRF multi-split systems. 86 FR 70644, 70652. In the December 2021 VRF TP NOPR, DOE tentatively determined that the proposed amendments to the test procedure, if made final, would alter the measured efficiency of VRF multi-split systems, as compared to ratings using the current Federal regulated metric, EER (*see* 10 CFR 431.97). In that document, DOE stated that were the proposed test procedure to be made final (*i.e.*, were DOE to adopt IEER as the metric for VRF multi-split systems), testing pursuant to the amended test procedure would not be required until such time as manufacturers were required to comply with amended energy conservation standards that are denominated in terms of IEER, should such standards be adopted. 86 FR 70644, 70652 (Dec. 10, 2021).

III. General Discussion

A. Methodology for Efficiency Crosswalk Analysis

1. Crosswalk Background and Overview

Consistent with the recommendation of the Working Group, DOE is proposing to amend the energy conservation standards for VRF multi-split systems to rely on the IEER metric for cooling efficiency. DOE is not proposing to amend the metric for heating efficiency (*i.e.*, COP). The Department has tentatively concluded that a change of metrics would be beneficial for a number of reasons. The current Federal metric for cooling efficiency, EER, captures the system performance at a single, full-load operating

point (*i.e.*, single outdoor air temperatures for air-cooled systems and single entering water temperatures for water-source systems). EER does not provide a seasonal or load-weighted measure of energy efficiency. In contrast, the IEER metric factors in the efficiency of operating at full-load conditions as well as part-load conditions of 75-percent, 50-percent, and 25-percent of full-load capacity. Under part-load conditions, air conditioning and heating equipment may cycle off/on or may modulate down the capacity in order to match the imposed load. DOE has tentatively determined that the IEER metric provides a more representative measure of field performance of VRF multi-split systems by weighting the full-load and part-load efficiencies by the average amount of time equipment spends operating at each load.

As stated, EPCA prohibits DOE from prescribing any amended standard that either increases the maximum allowable energy use or decreases the minimum required energy efficiency of a covered product. (42 U.S.C. 6313(a)(6)(B)(iii)(I)); commonly referred to as EPCA's "anti-backsliding provision") In consideration of the IEER metric and to ensure any potential amendment would not violate EPCA's "anti-backsliding" provision, DOE conducted a crosswalk analysis to validate the translation of the EER levels currently required by the DOE standards to IEER, as well as the IEER efficiency levels as recommended by the Working Group. The crosswalk analysis translates the current Federal EER standards (measured per the current DOE test procedure) to IEER levels of equivalent stringency (measured per the updated AHRI Standard 1230). (Docket No. EERE-2018-BT-STD-0003-0056).

The proposed energy conservation standards presented in this document were developed based on an update to the relevant industry test standard (*i.e.*, the 2019 draft test procedure AHRI 1230 that was finalized as ASHRAE 1230-2021). Compared to the

current Federal test procedure (which references ANSI/AHRI 1230-2010), AHRI 1230-2021 included two substantive changes that impact the translation of standards in EER to standards using IEER. Specifically, DOE considered in its crosswalk analysis in addition to the metric change from EER to IEER:

(1) Maximum sensible heat ratio (SHR) limits of 0.82 and 0.85 were added for full-load and 75-percent, part-load conditions, respectively. SHR represents the ratio of sensible cooling capacity (i.e., the ability to change the temperature of indoor air) to the total cooling capacity, which also includes latent cooling capacity (i.e., the ability to remove moisture from indoor air). For example, an SHR of 0.80 indicates that 80 percent of the capacity of a system reduces the temperature of the air and the remaining 20 percent dehumidifies the air.

(2) A controls verification procedure (CVP) was added that verifies that the values provided by manufacturers in the supplemental test instruction (STI) for setting critical parameters during steady-state testing are within the range of critical parameters that would be used by the system's native controls at the same conditions.

On November 5, 2019, DOE presented its crosswalk findings to the Working Group to inform the development of recommended standards levels for VRF multi-split systems in terms of the new test procedure and cooling metric. (Docket No. EERE-2018-BT-STD-0003-0056). To validate the relative equivalency of the IEER standard levels as recommended by the Working Group and the current Federal EER standards, DOE analyzed a minimally-compliant model from a high-sales-volume equipment class (with a current Federal standard of 10.6 EER) to ensure that translation of the current EER

standards to the recommended IEER values would not decrease the minimum required energy efficiency of VRF multi-split systems. As discussed, because of the change in metric and changes in the test procedure, DOE cannot translate the current EER to a single IEER value (further discussed in section III.A.3 of this NOPR). DOE identified the resulting crosswalked efficiency of the minimally-compliant model from the selected class ranged from 13 to 16 IEER.

DOE also presented to the Working Group anonymized and aggregated data provided by VRF multi-split system manufacturers. These data showed a preliminary translation of ratings to the IEER metric in terms of the updated test procedure for a collection of VRF multi-split systems spanning four equipment classes. The sample data were mostly composed of systems above the current Federal baseline efficiency levels in terms of EER and, thus, were not instructive as to a crosswalk of minimum energy efficiency levels. (Docket No. EERE-2018-BT-STD-0003-0056). The IEER efficiency level specified in the VRF ECS Term Sheet for the selected class was 13.9 IEER, which was within the range of crosswalked results.

Given that translating the current EER levels to IEER according to the updated test procedure does not provide for a single point answer (as would thereby allow for a direct comparison), DOE believes it is reasonable to ensure that the recommended value lies within the range resulting from DOE's evaluation as a proxy for understanding whether there is a potential for backsliding. Consequently, DOE has tentatively determined that the recommended IEER levels are at least equivalent in stringency to the current EER levels. Further, given that IEER is a more comprehensive metric (reflecting energy efficiency across a range of operating conditions, as opposed to the efficiency at a

single condition), DOE has tentatively determined that the recommended IEER levels would not decrease the minimum required energy efficiency of a VRF multi-split system.

2. Crosswalk Details

In its analysis to crosswalk the current DOE energy conservation standards for VRF cooling efficiency, DOE sought to account for the translation from EER to IEER, as well as changes in the updated industry test standard – namely the addition of SHR limits and the introduction of the CVP. Because these three factors have interacting effects on the measured cooling performance of VRF multi-split systems, DOE modeled their interaction holistically and did not examine incremental changes in performance due to any one factor.

As discussed, DOE is not proposing to change the heating efficiency metric (*i.e.*, COP), because both ASHRAE 90.1-2016 and the Working Group VRF ECS Term Sheet define heating mode efficiency in terms of COP. Additionally, the changes to the test procedure for VRF multi-split systems did not impact measured efficiency in heating mode. Therefore, DOE did not conduct a crosswalk analysis for VRF heating mode efficiency.

The following paragraphs describe DOE's crosswalk methodology to translate the current cooling efficiency standards for VRF multi-split systems that rely on the EER metric to standards using IEER that are of equivalent efficiency. DOE also identifies the various factors that limit the ability to strictly translate standards that rely on EER to standards that standards that rely on IEER.

In order to develop a crosswalk approach that is applicable to all equipment classes of VRF multi-split systems, DOE analyzed a basic model representative of

equipment classes with high sales volume.[11] Specifically, DOE selected an air-cooled VRF multi-split heat pump system in the cooling capacity range greater than 135,000 Btu/h and less than or equal to 240,000 Btu/h without heat recovery. The selected basic model had an EER rating within 0.2 points of the Federal standard for the applicable equipment class (*i.e.*, a 10.8 rating vs 10.6 EER minimum required), and 0.4 points above the Federal standard for the corresponding equipment class equipped with heat recovery (*i.e.*, a 10.8 rating vs 10.4 EER minimum required).

In support of the Working Group DOE, along with several manufacturers, DOE conducted investigative testing on VRF multi-split systems operating under native controls. Included in this testing was the basic model selected to serve as the basis for the crosswalk analysis. DOE created a performance model using VapCyc and CoilDesigner software[12] to evaluate capacity and efficiency of the selected system per the updated industry test standard. DOE first modeled the system's behavior at the full-load cooling condition by selecting compressor speed, outdoor fan speed, indoor airflow rate, and superheat condition to match information that was available in STI and provided confidentially by the manufacturer to DOE contractors under a nondisclosure agreement (NDA). DOE then calibrated the system as modeled in VapCyc and CoilDesigner so that the predicted capacity and EER matched the rated capacity and efficiency for the system (at full-load conditions) as certified by the manufacturer. Specifically, in its investigative testing, DOE observed typical control strategies for unloading at part-load conditions,

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[11] According to a report from Cadeo group, air-cooled VRF multi-split heat pump systems in the cooling capacity range greater than 135,000 Btu/h and less than or equal to 240,000 Btu/h without heat recovery account for 12.4 percent of the VRF multi-split system market. Air-cooled VRF multi-split systems in the same capacity range equipped with heat recovery account for an additional 32.6 percent of the VRF multi-split system market. (EERE-2017-BT-TP-0018-0002).

[12] VapCyc and CoilDesigner are HVAC energy modeling software programs. CoilDesigner is a detailed heat exchanger modeling program. VapCyc integrates CoilDesigner heat exchanger simulations with compressor and expansion models to complete a refrigeration cycle model to simulate performance of an air conditioning or heat pump system at specific operating conditions. Available at: *www.optimizedthermalsystems.com*.

including turning individual indoor units off, modulating compressor and fan speeds, and increasing evaporating temperature. DOE also observed patterns in which compressor speed and outdoor fan speed tended to scale together at reduced load conditions. DOE used this information to adjust the model so as to project the performance of the selected VRF multi-split system at partial loads by decreasing the operating state of components according to load level.

As discussed, the capacity and EER rating for the basic model used in DOE's analysis were measured according to the current DOE test procedure, but DOE is seeking to translate the current EER standards to equivalent IEER standards when tested according to the updated industry test standard. As such, DOE also considered in its crosswalk analysis the maximum SHR limits that were added in the industry test procedure AHRI 1230-2021. By establishing upper limits on SHR, DOE understands AHRI 1230-2021 to create test conditions that are more representative of field applications for VRF multi-split systems, as compared to the current DOE test procedure. AHRI 1230-2021 sets SHR limits of 0.82 and 0.85 at the full-load cooling condition and the 75-percent part-load cooling condition, respectively, but does not include SHR limits for the 50-percent or 25-percent part-load cooling conditions. AHRI 1230-2021 also establishes a calculation method for the efficiency rating reduction for systems that exceed the SHR limits at the full-load and/or 75-percent part-load cooling conditions in the IEER test.

Because manufacturers do not currently certify or publicize any information about SHR at the full-load EER test condition, DOE was unable to precisely determine SHR values representative of a baseline EER VRF multi-split system. Also, because the current DOE test procedure does not include any part-load cooling test points, no

information was available about SHR values that VRF multi-split systems would produce at the 75-percent part-load IEER test condition. Because SHR data was not publicly available, DOE instead examined data from its investigative testing to identify the typical range of SHR values for VRF multi-split systems when operating under native controls at the full-load and 75-percent part-load conditions. DOE observed several cases of basic models with native controls test data indicating SHR values above the AHRI 1230-2021 limits at the full-load and 75-percent part-load condition, and also observed some basic models testing below the SHR limits. The precision of the crosswalk from existing EER levels to IEER levels in terms of the updated industry test standard was limited by the lack of available data about representative SHR values at the full-load EER test condition and by the variation in SHR values observed in the native controls test data.

To account for the effect of the SHR limits in the updated industry test standard in its crosswalk analysis, DOE relied on the native controls test data to establish a range of potential initial SHR values observed at the full-load and 75-percent part-load IEER test conditions. DOE then adapted the VapCyc and CoilDesigner performance model to examine the effect of changing indoor airflow and evaporating temperature on SHR and the associated impacts on energy efficiency. Reducing the evaporating temperature increased the rate of dehumidification (thus reducing SHR), but also required more power input from the compressor, which reduced the measured efficiency. DOE also observed that at reduced airflow rates, the dehumidification capacity was higher, but the overall system capacity and efficiency were lower.

Ultimately, the crosswalked IEER values varied depending on modeling input assumptions, such as whether the initial SHR was below or above the new SHR limits (and by how much), as well as the different control strategies employed to reduce SHR.

The crosswalked IEER values also depended on overlapping input assumptions related to the EER-to-IEER translation, such as the number of thermally-active indoor units at part-load conditions. Reducing the number of indoor units at partial loads (while keeping all else constant) increased the amount of refrigerant flow to each remaining indoor fan coil, which provided better dehumidification performance and, thus, reduced SHR at the 75-percent load condition.

As discussed, the updates in AHRI 1230-2021 include a CVP for verifying that the certified operational settings for critical parameters are representative of values that would be observed with the VRF multi-split system operating under its own native controls. As described in AHRI 1230-2021, critical parameters include compressor speed(s), outdoor fan speed(s) and outdoor variable valve position(s). As proposed in the December 2021 VRF TP NOPR, manufacturers would specify operational settings for each of these components in their STI to implement during steady-state tests for IEER and COP. 86 FR 70644, 70666 (Dec. 10, 2021). The CVP is not a part of rating tests for IEER, but rather, it serves as a validation method for cooling mode only.

DOE's ability to fully account for the potential changes to the measured performance of VRF multi-split systems as a result of the CVP was limited by the lack of available information regarding the control strategies employed by VRF system manufacturers – particularly at part-load conditions where manufacturers do not currently certify or make public any information about control settings. DOE was also limited by uncertainty about how these control strategies may change or how manufacturers may certify their critical parameter settings in response to the CVP.

As discussed, the CVP is intended to validate that the certified operational settings (*i.e.*, those used during IEER testing) for critical parameters are representative of controls behavior exhibited under the system's own controls at the same conditions. DOE used information about the ranges of operational settings observed during native controls testing to represent a future system that would pass the CVP (*i.e.,* a system for which the certified critical parameter settings would be validated by a CVP conducted with the system operating under native controls). Specifically, DOE selected inputs used in its VapCyc and CoilDesigner performance model for simulating IEER that were consistent with native controls testing observations, including the number of thermally-active indoor units at part-load conditions, compressor and fan speeds, expansion valve control strategy, and other refrigeration cycle parameters. DOE tentatively concluded that modelling IEER results using control settings observed during native controls testing was the most accurate approach for estimating how manufacturers would certify critical parameter control settings as part of testing to IEER as measured by AHRI 1230-2021.

3. Crosswalk Results

As discussed, DOE conducted its crosswalk analysis on a high-sales-volume equipment class of VRF multi-split systems and selected a representative model with EER near the Federal baseline level (10.8 EER vs 10.6 EER baseline) in developing its VapCyc and CoilDesigner performance model. Based on the modeling conducted, the expected performance of the selected equipment class of VRF multi-split systems when tested according to AHRI 1230-2021 would be in the range of 13 to 16 IEER. Because of the wider range of operation conditions captured in IEER as well as the various strategies that manufacturers may employ to respond to the test procedure changes, a single EER baseline value inherently translates to a range of IEER values.

As discussed, the IEER metric captures performance at additional part-load operating conditions not considered by the EER metric; therefore, a single EER value translates to a range of potential IEER values.[13] IEER captures the impacts of design features and control strategies that may not affect full-load operation but do affect part-load operation. For example, VRF multi-split systems may use different strategies for reducing capacity at part loads like reducing the number of thermally active indoor units or slowing compressor speeds, which may result in differential impacts on measured IEER, but which would not have any impact on the measured full-load performance EER. DOE also recognizes that there are a variety of paths that manufacturers may take to account for the new test procedure, and that the crosswalk analysis approximates how manufacturers in the aggregate may respond to test procedure changes. For example, some manufacturers may elect to meet the new SHR limitations by reducing evaporating temperatures, while other manufacturers may meet the new SHR limitations by reducing indoor airflow and decreasing the number of thermally-active indoor units. Each strategy may have different tradeoffs in terms of overall system performance and measured energy efficiency.

As described in section II.B.3 of this document, the Working Group recommended efficiency levels for VRF multi-split systems that align with the efficiency levels specified in ASHRAE 90.1-2016 in terms of IEER and COP. While DOE's crosswalk analysis showed that a single EER baseline could result in a range of IEER values (as discussed, due to the wider range of operation conditions captured in IEER, as well as the various strategies that manufacturers may employ to respond to the test procedure changes), the IEER levels included in the VRF ECS Term Sheet (which the

[13] In a January 2016 energy conservation standards direct final rule for ACUACs, DOE discussed a metric translation from EER to IEER in which a single EER level corresponds to a range of IEERs. 81 FR 2420, 2452 (Jan. 15, 2016).

Working Group recommended as an appropriate crosswalk of current Federal EER standards) are within the range of DOE's crosswalked results. As explained previously, DOE has tentatively determined that the recommended IEER levels are at least equivalent in stringency to the current EER levels. Further, given that IEER is a more comprehensive metric (reflecting energy efficiency across a range of operating conditions, as opposed to the efficiency at a single condition), DOE has tentatively determined that the recommended IEER levels would not decrease the minimum required energy efficiency of a VRF multi-split system, thereby avoiding statutorily impermissible backsliding with respect to the current Federal standards in terms of EER. DOE has also tentatively determined that no changes to heating mode ratings in terms of COP are expected from the changes to the test procedure for VRF multi-split systems included in AHRI 1230-2021.

Issue 1: DOE requests comment on its crosswalk analysis methodology and crosswalk results.

B. Equipment Class Structure for VRF

In the July 2019 NODA/RFI, DOE discussed two areas where the equipment class structure for VRF multi-split systems differs between ASHRAE Standard 90.1 and the Federal standards. 84 FR 32328, 32334 (July 8, 2019). First, DOE noted that in ASHRAE Standard 90.1-2016 (as in previous versions of ASHRAE Standard 90.1), two water-source VRF multi-split heat pump equipment classes (greater than or equal to 17,000 Btu/h and less than 65,000 Btu/h; and greater than or equal to 65,000 Btu/h and less than 135,000 Btu/h) are disaggregated into equipment with heat recovery and equipment without heat recovery, with each ASHRAE equipment class having a separate minimum cooling efficiency. The current Federal standards do not disaggregate water-

source VRF multi-split heat pumps in these capacity ranges based on the presence of heat recovery. (*See* Table 13 to 10 CFR 431.97.) However, as DOE pointed out in the NODA/RFI, the cooling efficiency EER standard in ASHRAE Standard 90.1-2016 for these units with heat recovery is below the current Federal standard. Consequently, under EPCA, the Secretary cannot prescribe those levels due to anti-backsliding concerns, so those classes were not subdivided further. *Id.*

Second, DOE identified that ASHRAE Standard 90.1-2016 disaggregates and sets distinct standards for VRF water-source heat pumps by cooling capacity above and below 240,000 Btu/h (*i.e.,* separate equipment classes with cooling capacities greater than or equal to 135,000 Btu/h and less than 240,000 Btu/h and greater than or equal to 240,000 Btu/h and less than 760,000 Btu/h). The DOE standards provide for VRF water-source heat pumps with a cooling capacity of greater than or equal to 135,000 Btu/h and less than 760,000 Btu/h. (*See* table 13 to 10 CFR 431.97.) DOE sought feedback from stakeholders on whether to consider additional equipment classes for VRF water-source heat pumps between 135,000 and 760,000 Btu/h, which would align with the ASHRAE 90.1-2016 structure for those classes of equipment. *Id.*

In response to the July 2019 NODA/RFI, AHRI and the CA IOUs both commented that DOE should align its equipment class structure for all classes of VRF multi-split systems with the equipment structure found in ASHRAE 90.1-2016 (*i.e.,* not just for the specific equipment classes on which DOE requested comment). (AHRI, No. 42 at p. 3; CA IOUs, No. 41 at p. 3) AHRI commented that aligning with ASHRAE 90.1 would reflect the structure of other VRF classes, such as air-cooled heat pumps and air conditioners. (AHRI, No. 42 at p. 3) The CA IOUs commented that aligning with the equipment structure in ASHRAE 90.1-2016 would provide additional clarity regarding

which standards apply to heat pumps versus units with heat recovery. (CA IOUs, No. 41 at pp. 3-4) The CA IOUs further commented that for air-source VRF multi-split heat pumps, in order to be more easily understood by the market, DOE should align with the convention from ASHRAE Standard 90.1 by adding a new column titled "subcategory" that specifies "heat pump" or "heat pump with heat recovery" and should remove its existing designation of "no heating or electric resistance heating" and "all other types of heating," which is terminology more applicable to commercial unitary air conditioners than to VRF multi-split systems. (CA IOUs, No. 41 at p. 3) The CA IOUs also recommended that DOE should follow ASHRAE regarding breaking out the 135,000 Btu/h to 760,000 Btu/h categorization into two size categories, and that DOE should eliminate the 17,000 Btu/h cutoff for water-source equipment so as to align with ASHRAE. *Id.*

As stated, EPCA generally directs DOE to establish amended uniform national standards for the VRF multi-split systems at the minimum levels specified in ASHRAE Standard 90.1. (42 U.S.C. 6313(a)(6)(A)(ii)(I)) Consistent with EPCA, and in consideration of the comments received, DOE proposes to adopt the ASHRAE 90.1-2016 equipment class structure for VRF multi-split systems in its regulations at 10 CFR 431.97. By adopting the equipment class structure from ASHRAE Standard 90.1-2016, DOE would fulfill requests by stakeholders, utilize terminology that is more representative of distinctive features in the VRF market, and would better align the cooling capacity break points with those for other equipment categories (*e.g.*, the standards for commercial package air conditioning and heating equipment, which are subdivided by the same capacity boundaries. *See* Table 3 to 10 CFR 431.97). As noted previously, DOE has identified two areas for which the equipment class structure differs between the existing DOE standards and ASHRAE Standard 90.1.

(1) Capacity break points. For water-source VRF multi-split heat pumps, the current Federal standards include VRF multi-split systems with cooling capacity greater than or equal to 135,000 Btu/h and less than 760,000 Btu/h in a single category. ASHRAE Standard 90.1-2016 splits this grouping at 240,000 Btu/h to create capacity categories of greater than or equal to 135,000 and less than 240,000 btu/h and greater than or equal to 240,000 and less than 760,000 Btu/h. Also for water-source VRF multi-split systems, the current Federal standards include separate classes for systems with cooling capacity less than 17,000 Btu/h and for systems with cooling capacity between 17,000 Btu/h and 65,000 Btu/h. ASHRAE Standard 90.1-2016 groups these classes together into a single equipment class with cooling capacity less than 65,000 Btu/h.

(2) Heating type. The current Federal standards are disaggregated for certain classes of VRF multi-split systems based on heating type. For all air-cooled VRF multi-split air conditioners and heat pumps with cooling capacity greater than or equal to 65,000 Btu/h, the Federal cooling standards differ by 0.2 EER points depending on whether a system is equipped with "no heating or electric resistance heating" or "all other types of heating." For water-source VRF multi-split heat pumps, some capacity classes disaggregate instead by systems with heat recovery versus without heat recovery (also with a 0.2 EER difference in the applicable standards classes). Other water-source VRF multi-split heat pump standards are not disaggregated beyond the specified capacity range. ASHRAE 90.1-2016 disaggregates standards for air-cooled and water-source VRF multi-split heat pumps based on the presence of heat recovery, instead of "heating type." Air-cooled VRF multi-split air

conditioners do not have subdivided cooling efficiency levels based on heating type in ASHRAE Standard 90.1-2016.

These differences are presented in Table III-1:

Table III-1: Comparison of Current DOE Efficiency Levels with ASHRAE 90.1

Equipment Type	Cooling Capacity	Heating Type	DOE Efficiency Level	ASHRAE 90.1-2016/2019 Efficiency Level
VRF Multi-Split Air Conditioners (Air-Cooled)	≥65,000 Btu/h and <135,000 Btu/h	No Heating or Electric Resistance Heating	11.2 EER	11.2 EER, 15.5 IEER
		All Other Types of Heating	11.0 EER	No Standard[3]
	≥135,000 Btu/h and <240,000 Btu/h	No Heating or Electric Resistance Heating	11.0 EER	11.0 EER, 14.9 IEER
		All Other Types of Heating	10.8 EER	No Standard[3]
	≥240,000 Btu/h and <760,000 Btu/h	No Heating or Electric Resistance Heating	10.0 EER	10.0 EER, 13.9 IEER
		All Other Types of Heating	9.8 EER	No Standard[3]
VRF Multi-Split Heat Pumps (Air-Cooled)	≥65,000 Btu/h and <135,000 Btu/h	No Heating or Electric Resistance Heating[1]	11.0 EER, 3.3 COP	11.0 EER, 14.6 IEER, 3.3 COP
		All Other Types of Heating[1,2]	10.8 EER, 3.3 COP	10.8 EER, 14.4 IEER, 3.3 COP
	≥135,000 Btu/h and <240,000 Btu/h	No Heating or Electric Resistance Heating[1]	10.6 EER, 3.2 COP	10.6 EER, 13.9 IEER, 3.2 COP

		All Other Types of Heating[1,2]	10.4 EER, 3.2 COP	10.4 EER, 13.7 IEER, 3.2 COP
	≥240,000 Btu/h and <760,000 Btu/h	No Heating or Electric Resistance Heating[1]	9.5 EER, 3.2 COP	9.5 EER, 12.7 IEER, 3.2 COP
		All Other Types of Heating[1,2]	9.3 EER, 3.2 COP	9.3 EER, 12.5 IEER, 3.2 COP
VRF Multi-Split Heat Pumps (Water-Source)	<17,000 Btu/h	Without heat recovery	12.0 EER, 4.2 COP	12.0 EER, 16.0 IEER, 4.3 COP
		With heat recovery	11.8 EER, 4.2 COP	11.8 EER, 15.8 IEER, 4.3 COP
	≥17,000 Btu/h and <65,000 Btu/h	Without heat recovery	12.0 EER, 4.2 COP	12.0 EER, 16.0 IEER, 4.3 COP
		With heat recovery		11.8 EER, 15.8 IEER, 4.3 COP
	≥65,000 Btu/h and <135,000 Btu/h	Without heat recovery	12.0 EER, 4.2 COP	12.0 EER, 16.0 IEER, 4.3 COP
		With heat recovery		11.8 EER, 15.8 IEER, 4.3 COP
	≥135,000 Btu/h and <240,000 Btu/h	Without heat recovery	10.0 EER, 3.9 COP	10.0 EER, 14.0 IEER, 4.0 COP
		With heat recovery	9.8 EER, 3.9 COP	9.8 EER, 13.8 IEER, 4.0 COP
	≥ 240,000 Btu/h and <760,000 Btu/h	Without heat recovery	10.0 EER, 3.9 COP	10.0 EER, 12.0 IEER, 3.9 COP
		With heat recovery	9.8 EER, 3.9 COP	9.8 EER, 11.8 IEER, 3.9 COP

[1] In terms of current Federal standards, VRF Multi-Split Heat Pumps (Air-Cooled) with heat recovery fall under the heating type "All Other Types of Heating" unless they also have electric resistance heating, in which case it falls under the category for "No Heating or Electric Resistance Heating."

[2] In ASHRAE Standard 90.1, this equipment class is referred to as units with heat recovery rather than all other types of heating.

[3] ASHRAE Standard 90.1 only includes standards for VRF air conditioners with "electric resistance or none" heating type. Because stakeholders have expressed that it is unlikely that VRF air conditioners would ever be paired with other forms of supplemental heating, DOE's proposed equipment classes for VRF air conditioners are condensed using "all types of heating" to ensure no change in coverage or backsliding.

In this document, DOE proposes to amend 10 CFR 431.97 to adopt the equipment class structure found in ASHRAE 90.1-2016 for VRF multi-split systems (which is identical to the most current version, ASHRAE Standard 90.1-2019). This proposal would amend the existing DOE class structure by expanding the number of VRF water-source heat pump classes, reducing the number of air-cooled VRF air conditioner classes, and amending the convention for heating type for heat pump systems with and without heat recovery. Additionally, DOE is proposing a minor clarification in the language used to describe the heating type for VRF multi-split system heat pumps – ASHRAE 90.1-2016 currently includes separate classes for systems with and without heat recovery, designated as "VRF multisplit systems" or "VRF multisplit system with heat recovery." However, DOE proposes a minor clarification to revise these descriptions to explicitly state either "heat pump without heat recovery" or "heat pump with heat recovery."

For VRF multi-split system air conditioners, ASHRAE 90.1-2016 only includes classes with the heating type designation of "Electric resistance (or none)," thus excluding any VRF multi-split air conditioners with "other" kinds of heating. As previously described, DOE received comment from stakeholders requesting that DOE align its equipment class structure with the structure from ASHRAE 90.1-2016. (AHRI, No. 42 at p. 3; CA IOUs, No. 41 at p. 3) However, because the current Federal standards include separate efficiency levels for VRF multi-split air conditioners having electric resistance (or no) heat vs. those having "all other types of heating," DOE is proposing to label the condensed equipment classes for VRF multi-split air conditioners as having "All" types of heating, and to set IEER standards for the proposed condensed classes that are equivalent in stringency to the EER standards for the class with "electric resistance or none" heating type. DOE does not have any knowledge of VRF multi-split air conditioners on the market that have "all other types of heating" (*e.g.*, a furnace), and,

thus, has tentatively concluded that setting IEER standards to cover "all" kinds of heating would not constitute an increase of stringency for any models currently in existence.

The ASRAC Working Group recommended IEER levels for VRF multi-split systems that utilized the equipment class structure of ASHRAE Standard 90.1-2016 (with limited exceptions as previously described). As discussed in section III.A of this document, DOE evaluated the IEER levels recommended by the ASRAC Working Group using a crosswalk analysis and determined that there is limited precision in translating the current EER levels to IEER according to the updated test procedure. In cases where DOE is proposing to subdivide or condense equipment classes relative to the existing DOE equipment class structure, the IEER levels recommended by the Working Group are within the limits of precision determined by DOE's crosswalk translation. For example, in cases where the current DOE equipment class only includes a single EER standard but ASHRAE Standard 90.1-2016 includes separate IEER standards for classes with and without heat recovery, both of the ASHRAE Standard 90.1 IEER levels fall within the crosswalk range determined by DOE to represent equivalent stringency to existing EER standard. Therefore, DOE has tentatively concluded that adopting the proposed class structure and efficiency levels would not result in a change in stringency for any classes.

Issue 2: DOE requests comment on its proposal to align equipment classes for VRF multi-split systems with the structure in ASHRAE Standard 90.1-2016, with additional clarification of heating type.

IV. Estimates of Potential Energy Savings

As required under 42 U.S.C. 6313(a)(6)(A)(i), for VRF multi-split system equipment classes for which ASHRAE Standard 90.1-2016 set levels more stringent than

the current Federal standards, DOE performed an assessment to determine the energy-savings potential of amending Federal standard levels to reflect the efficiency levels specified in ASHRAE Standard 90.1-2016. In the July 2019 NODA/RFI, DOE presented the findings of the energy savings potential for the six considered equipment classes for which the Department was triggered. 84 FR 32328, 32335 (July 8, 2019). DOE tentatively determined, based on a report by Cadeo Group,[14] that four of the six affected classes – those with cooling capacities that are less than 17,000 Btu/h or greater than or equal to 135,000 Btu/h (with or without heat recovery), do not have any market share and, thus, no energy savings potential from amended standards. The Cadeo report showed that the remaining two affected classes, with cooling capacities greater than 17,000 Btu/h and less than 135,000 Btu/h, represented under 3 percent of the VRF multi-split system market. DOE tentatively concluded that potential energy savings for these equipment classes were *de minimis*. *Id*. DOE notes that in ASHRAE Standard 90.1-2016, the COP was raised by 0.1 on both of these equipment classes, and that most commercial buildings are cooling dominant. Given this information, and the small market share, in this NOPR DOE maintains its tentative conclusion that energy savings for these equipment classes are *de minimis*. Consideration of more-stringent efficiency levels than those specified in ASHRAE Standard 90.1 are discussed in section V.A of this document.

V. Conclusions

A. Consideration of More-Stringent Efficiency Levels

[14] Cadeo Report, Variable Refrigerant Flow: A Preliminary Market Assessment. *See*: *www.regulations.gov/document?D=EERE-2017-BT- TP-0018-0002*. The report presents market share by VRF multi-split system equipment class, based on confidential sales data given in interviews with several major manufacturers of VRF multi-split equipment and DOE's Compliance Certification Database.

When triggered by an update to ASHRAE Standard 90.1, EPCA requires DOE to establish an amended uniform national standard for equipment classes at the minimum level specified in the amended ASHRAE Standard 90.1 unless DOE determines, by rule published in the *Federal Register* and supported by clear and convincing evidence, that adoption of a uniform national standard more stringent than the amended ASHRAE Standard 90.1 for the equipment class would result in significant additional conservation of energy and is technologically feasible and economically justified. (42 U.S.C. 6313(a)(6)(A)(ii)(I)-(II)). In the July 2019 NODA/RFI, DOE requested feedback on its proposal to adopt the levels in ASHRAE Standard 90.1-2016 as the Federal standards for the six VRF water-source classes for which DOE was triggered by ASHRAE Standard 90.1-2016. 84 FR 32328, 32335 (July 8, 2019). DOE also requested data and information that could help it determine whether standards levels more stringent than the levels in ASHRAE Standard 90.1-2016 for VRFs would result in significant additional energy savings for classes for the 14 classes where DOE was not triggered (*i.e.*, classes reviewed under the six-year-lookback provision). *Id*. at 84 FR 32335-32336.

AHRI supported DOE's proposal to adopt the energy efficiency levels for the six equipment classes triggered by ASHRAE Standard 90.1-2016. (AHRI, No. 42 at p. 3) AHRI added that the adoption of a more-stringent standard of the non-triggered classes is not economically justified at this time and that the stringency of any new standards need to account for all of the changes in the test procedure as a result of the Working Group negotiations (especially the CVP and SHR limits). (AHRI, No. 42 at p. 4) AHRI also provided information regarding the building types that are common applications for VRF. (AHRI, No. 42 at p. 4)

The CA IOUs recommended that the Working Group and DOE analyze a range of efficiency levels (including max-tech) for both water-source and air-source VRF systems. The CA IOUs also stressed that any changes to the energy conservation standards should account for the test procedure changes being discussed by the Working Group. The CA IOUs acknowledged that while DOE's data show limited sales on water-source VRF multi-split systems, they still believe that the Working Group should analyze trial standard levels for these classes. (CA IOUs, No. 41 at p. 4) The CA IOUs provided a set of historical VRF incentive program data to assist in the energy use analysis and recommended that DOE use Energy Plus[15] to analyze the energy use of VRF multi-split systems. (CA IOUs, No. 41 at pp. 6-12)

HIA-C commented that DOE should first ensure that VRF multi-split systems can actually meet the current ASHRAE Standard 90.1 efficiency levels before attempting to adopt new efficiency levels. (HIA-C, No. 40 at p. 4)

Policy Integrity commented on the emissions analysis, suggesting that DOE should monetize the full benefits of emissions reductions and use the global estimate of the social cost of greenhouse gases. (Policy Integrity, No. 39 at p. 2) In response, DOE considers the monetary benefits likely to result from the reduced emissions of greenhouse gases when analyzing efficiency levels more stringent than the ASHRAE Standard 90.1 levels. DOE uses the social cost of greenhouse gases from the most recent update of the Interagency Working Group on Social Cost of Greenhouse Gases, United States Government (IWG) working group, which are available in the Technical Support Document: Social Cost of Carbon, Methane, and Nitrous Oxide Interim Estimates under

[15] Energy Plus is a whole-building energy simulation program that engineers, architects, and researchers use to model both energy consumption for heating cooling, ventilation, lighting, plug and process loads, and water use in buildings. (Available at *https://energyplus.net/*)

Executive Order 13990.[16] The IWG recommended global values be used for regulatory analysis. Because DOE is not conducting an economic analysis of levels more stringent than the ASHRAE Standard 90.1 levels in this notice, there is no corresponding consideration of emission reductions or the associated monetary benefits. As DOE is required by EPCA to adopt the levels set forth in ASHRAE Standard 90.1, DOE did not conduct an economic analysis or corresponding emissions analysis for the levels in ASHRAE Standard 90.1-2019.

As discussed in section II.B.3 of this NOPR, following publication of the July 2019 NODA/RFI, the Working Group (which included AHRI and the CA IOUs) reached consensus on two term sheets containing recommendations regarding the test procedure and energy conservation standards for VRF multi-split systems. As discussed in section III.A of this document, the recommended standards are consistent with the crosswalk conducted by DOE to translate the existing Federal standards in terms of EER to equivalent levels in terms of IEER, measured per AHRI 1230-2021. These recommended efficiency levels also align with the IEER and COP levels in ASHRAE Standard 90.1-2016. The Working Group did not consider more-stringent efficiency levels.

DOE considered but did not estimate potential energy savings that would occur from more-stringent standards. To assess the magnitude of potential energy savings from amended standards and determine which level, if any, of more-stringent standards would be economically justified, DOE must be able to properly represent the no-new-standards case – the case without amended standards – and must be able to properly characterize the technology options and costs associated with specific levels of efficiency. With

[16] Interagency Working Group on Social Cost of Greenhouse Gasses, United States Government, Technical Support Document: Social Cost of Carbon, Methane, and Nitrous Oxide Interim Estimates under Executive Order 13990 (2021) (Available at: *www.whitehouse.gov/wp-content/uploads/2021/02/TechnicalSupportDocument_SocialCostofCarbonMethaneNitrousOxide.pdf*).

regards to VRF multi-split systems, this would require developing efficiency data for the entire market in terms of IEER measured per AHRI 1230-2021.

DOE considered two approaches for developing market-wide performance data in terms of IEER measured per AHRI 1230-2021: (1) DOE examined whether any such data exist in publicly-available sources, and (2) DOE considered whether existing performance data (in terms of EER, measured per the current Federal test procedure) could be effectively translated to IEER, measured per AHRI 1230-2021.

On the first approach, DOE found that public data in terms of IEER measured per AHRI 1230-2021 are not available, as the rating of VRF multi-split systems using the updated metric and test procedure is not currently required.[17] While DOE acknowledges that IEER performance data are widely represented by VRF manufacturers, all such data are measured per an earlier version of the industry test standard (AHRI 1230-2014) and, thus, not directly comparable. DOE also found that the AHRI Directory does not yet require IEER representations measured per AHRI 1230-2021.

On the second approach, DOE considered the results of its crosswalk analysis to determine whether a market-wide translation of existing EER data to IEER data (measured per AHRI 1230-2021) was possible. As discussed in section III.A of this document, the combined effect of translating the Federal cooling efficiency metric from EER to IEER and the effect of test procedure changes between the current DOE test procedure (which references AHRI 1230-2010) and the proposed DOE test procedure (which would reference AHRI 1230-2021) is likely to produce different impacts on measured efficiency across different manufacturers and different models. As DOE's

[17] The VRF TP Term Sheet recommended an effective date for the amended test procedure to coincide with the compliance date of amended standards in terms of IEER, if adopted by DOE.

crosswalk analysis has shown, a minimally-compliant VRF multi-split system with 10.8 EER can result in a range of crosswalked IEER levels from 13 to 16, depending on control inputs selected by the manufacturer. Additionally, an estimation of energy savings potentials of more-stringent energy efficiency levels would require developing efficiency data for the entire VRF multi-split system market, which would be a much broader analysis than that conducted for the crosswalk. The crosswalk analysis conducted to support the Working Group recommendations and presented in this NOPR only translated the baseline efficiency level between the metrics for a single class of VRF multi-split system, and did not translate all efficiency levels currently represented in the market. As noted, there are insufficient market data regarding the performance of VRF multi-split systems measured in terms of IEER per AHRI 1230-2021. As such, DOE has preliminarily determined that it lacks clear and convincing evidence to adopt more-stringent standard levels.

Regardless of whether DOE preliminarily determined that more-stringent standards would be technologically feasible and economically justified, DOE would be unable to adopt such standards absent a determination, supported by clear and convincing evidence, that more-stringent standards would result in significant additional energy savings. (42 U.S.C. 6313(a)(6)(A)(ii)(II)) Therefore, having preliminarily determined that it lacks clear and convincing evidence as to the energy savings that would result from more-stringent standards, DOE has not conducted analysis as to the technological feasibility or economic justification of such standards for VRF multi-split systems.

B. Review Under the Six-Year Lookback Provision

As discussed, DOE is required to conduct an evaluation of each class of covered equipment in ASHRAE Standard 90.1 every six years. (42 U.S.C. 6313(a)(6)(C)(i))

Accordingly, DOE is evaluating 12 of the Federal VRF equipment classes for which ASHRAE Standard 90.1-2016 did not increase the stringency of the standards. Energy conservation standards for the two remaining classes of VRF multi-split systems (*i.e.*, three-phase, air-cooled VRF multi-split systems with cooling capacity less than 65,000 Btu/h) are not addressed in this NOPR and instead will be addressed in a separate energy conservation standards rulemaking. DOE may only adopt more-stringent standards pursuant to the six-year look-back review if the Secretary determines, by rule published in the *Federal Register* and supported by clear and convincing evidence, that the adoption of more-stringent standards would result in significant additional conservation of energy and is technologically feasible and economically justified. (42 U.S.C. 6313(a)(6)(C)(i)(II); 42 U.S.C. 6313(a)(6)(B); 42 U.S.C. 6313(a)(6)(A)(ii)(II))

For the reasons presented in the prior section, DOE has preliminarily determined that it lacks clear and convincing evidence that more-stringent standards for these 12 equipment classes would result in significant additional energy savings. Because DOE does not have sufficient data to meet the "clear and convincing" threshold for these 12 classes, DOE did not conduct an analysis of standard levels more stringent than the current Federal standard levels for VRF multi-split systems that were not amended in ASHRAE Standard 90.1-2016. See section V.A of this document for further discussion of the consideration of energy efficiency levels more stringent than the ASHRAE Standard 90.1-2016 levels.

C. Proposed Energy Conservation Standards

Based on the foregoing, DOE proposes amended energy conservation standards for VRF multi-split systems in terms of IEER and COP equivalent to those specified for VRF multi-split systems in ASHRAE Standard 90.1-2016, which align with the levels

recommended in the VRF ECS Term Sheet. The proposed standards are presented in Table I-1. Compliance with the proposed standards, if adopted, would be required for VRF multi-split systems manufactured in, or imported into, the United States starting January 1, 2024. which aligns with the Working Group's recommendation in the VRF ECS Term Sheet.

As discussed, ASHRAE Standard 90.1-2016 includes more-stringent COP standards for six water-source VRF multi-split heat pump classes. If DOE were to prescribe COP standards at the efficiency levels contained in ASHRAE Standard 90.1-2016 for these classes, EPCA provides that the compliance date shall be on or after a date that is two or three years (depending on the equipment type or size) after the effective date of the applicable minimum energy efficiency requirement in the amended ASHRAE standard. (42 U.S.C. 6313(a)(6)(D)). The effective date for amended COP standards in ASHRAE Standard 90.1-2016 was January 1, 2017. DOE acknowledges that the statute originally tied calculation of a compliance date to either two or three years after the effective date of amended ASHRAE Standard 90.1. However, because these dates have passed, DOE is proposing the date recommended in the VRF ECS Term Sheet (*i.e.*, January 1, 2024) as a reasonable amount of lead time supported by a broad array of interested stakeholders. If DOE receives comments in response to this notice that recommend alternative compliance date(s) later than January 1, 2024, DOE will consider adopting alternative compliance date(s) in the final rule.

VI. Procedural Issues and Regulatory Review

A. Review Under Executive Orders 12866 and 13563

Section 1(b)(1) of Executive Order (E.O.) 12866, "Regulatory Planning and Review," 58 FR 51735 (Oct. 4, 1993), requires each agency to identify the problem that it intends to address, including, where applicable, the failures of private markets or public institutions that warrant new agency action, as well as to assess the significance of that problem. The problems that the proposed standards for VRF multi-split systems set forth in this NOPR are intended to address are as follows:

(1) Insufficient information and the high costs of gathering and analyzing relevant information leads some consumers to miss opportunities to make cost-effective investments in energy efficiency.

(2) In some cases, the benefits of more-efficient equipment are not realized due to misaligned incentives between purchasers and users. An example of such a case is when the equipment purchase decision is made by a building contractor or building owner who does not pay the energy costs.

(3) There are external benefits resulting from improved energy efficiency of appliances and equipment that are not captured by the users of such products. These benefits include externalities related to public health, environmental protection, and national energy security that are not reflected in energy prices, such as reduced emissions of air pollutants and greenhouse gases that impact human health and global warming. DOE attempts to quantify some of the external benefits through use of social cost of carbon values.

The Administrator of the Office of Information and Regulatory Affairs (OIRA) in the Office of Management and Budget (OMB) has determined that this regulatory action is not a significant regulatory action under section 3(f) of E.O. 12866. Accordingly, DOE

has not prepared a regulatory impact analysis for this rule, and OIRA in the OMB has not reviewed this proposed rule.

DOE has also reviewed this regulation pursuant to E.O. 13563, issued on January 18, 2011. 76 FR 3821 (Jan. 21, 2011). E.O. 13563 is supplemental to and explicitly reaffirms the principles, structures, and definitions governing regulatory review established in E.O. 12866. To the extent permitted by law, agencies are required by E.O. 13563 to: (1) propose or adopt a regulation only upon a reasoned determination that its benefits justify its costs (recognizing that some benefits and costs are difficult to quantify); (2) tailor regulations to impose the least burden on society, consistent with obtaining regulatory objectives, taking into account, among other things, and to the extent practicable, the costs of cumulative regulations; (3) select, in choosing among alternative regulatory approaches, those approaches that maximize net benefits (including potential economic, environmental, public health and safety, and other advantages; distributive impacts; and equity); (4) to the extent feasible, specify performance objectives, rather than specifying the behavior or manner of compliance that regulated entities must adopt; and (5) identify and assess available alternatives to direct regulation, including providing economic incentives to encourage the desired behavior, such as user fees or marketable permits, or providing information upon which choices can be made by the public.

DOE emphasizes as well that E.O. 13563 requires agencies to use the best available techniques to quantify anticipated present and future benefits and costs as accurately as possible. In its guidance, OIRA has emphasized that such techniques may include identifying changing future compliance costs that might result from technological innovation or anticipated behavioral changes. For the reasons stated in the preamble, this

NOPR is consistent with these principles, including the requirement that, to the extent permitted by law, benefits justify costs and that net benefits are maximized.

B. Review Under the Regulatory Flexibility Act

The Regulatory Flexibility Act (5 U.S.C. 601 *et seq*.) requires preparation of an initial regulatory flexibility analysis (IRFA) for any rule that by law must be proposed for public comment, unless the agency certifies that the rule, if promulgated, will not have a significant economic impact on a substantial number of small entities. As required by E.O. 13272, "Proper Consideration of Small Entities in Agency Rulemaking," 67 FR 53461 (August 16, 2002), DOE published procedures and policies on February 19, 2003, to ensure that the potential impacts of its rules on small entities are properly considered during the DOE rulemaking process. 68 FR 7990. DOE has made its procedures and policies available on the Office of the General Counsel's website (*https://energy.gov/gc/office-general-counsel*).

DOE reviewed this proposed rule to amend the Federal energy conservation standards for VRF multi-split systems under the provisions of the Regulatory Flexibility Act and the procedures and policies published on February 19, 2003. DOE certifies that the proposed rule, if adopted, would not have significant economic impact on a substantial number of small entities. The factual basis of this certification is set forth in the following paragraphs.

DOE is proposing to amend the existing Federal minimum energy conservation standards for VRF multi-split systems under EPCA's ASHRAE trigger requirement and the six-year lookback provision. Under the trigger, EPCA directs that if ASHRAE amends ASHRAE Standard 90.1, DOE must adopt uniform national amended standards

at the new ASHRAE efficiency level, unless DOE determines, by rule published in the *Federal Register* and supported by clear and convincing evidence, that adoption of a more-stringent level would produce significant additional conservation of energy and would be technologically feasible and economically justified. (42 U.S.C. 6313(a)(6)(A)(ii)) Under the six-year-lookback, DOE must also review energy efficiency standards for VRF multi-split systems every six years and either: (1) issue a notice of determination that the standards do not need to be amended based upon the criteria in 42 U.S.C. 6313(a)(6)(A) (*i.e.*, that there is clear and convincing evidence to show that adoption of a more-stringent level would save significant additional energy and would be technologically feasible and economically justified); or (2) issue a notice of proposed rulemaking including new proposed standards based on certain criteria and procedures in 42 U.S.C. 6313(a)(6)(B). (42 U.S.C. 6313(a)(6)(C))

In this NOPR, DOE proposes to update the standards for VRF multi-split systems at 10 CFR 431.97 to align with the most recent version of ASHRAE Standard 90.1, including the updated COP levels for the six classes of VRF multi-split water-source heat pumps on which DOE was triggered. DOE is also proposing to express cooling efficiency standards in terms of the IEER metric, as measured according to the amended industry test procedure AHRI 1230-2021, and to remove standard levels in terms of the EER metric, as measured according to the current DOE test procedure. Finally, DOE is proposing to amend the equipment class structure for VRF multi-split systems to align with the equipment class structure present in ASHRAE Standard 90.1, with regards to capacity break points, supplementary heating type, and presence of heat recovery. The proposed standard levels, if adopted, would have a compliance date applying to all VRF multi-split systems manufactured on or after January 1, 2024. The proposed Table 14 to 10 CFR 431.97 accounts for all changes between the previous Federal VRF multi-split

system standards and those outlined in ASHRAE Standard 90.1-2016 (as reaffirmed in ASHRAE Standard 90.1-2019).

DOE uses the Small Business Administration (SBA) small business size standards to determine whether manufacturers qualify as small businesses, which are listed by the North American Industry Classification System (NAICS).[18] The SBA considers a business entity to be a small business, if, together with its affiliates, it employs less than a threshold number of workers specified in 13 CFR part 121.

VRF multi-split system manufacturers are classified under NAICS code 333415, "Air-Conditioning and Warm Air Heating Equipment and Commercial and Industrial Refrigeration Equipment Manufacturing." The SBA sets a threshold of 1,250 employees or fewer for an entity to be considered as a small business for this category. This employee threshold includes all employees in a business's parent company and any other subsidiaries.

DOE has recently conducted a focused inquiry into small business manufacturers of the equipment covered by this rulemaking. DOE used available public information to identify potential small manufacturers that manufacture domestically. DOE identified manufacturers using DOE's Compliance Certification Database[19] and the AHRI Directory database.[20] DOE used this publicly-available information to identify ten distinct original equipment manufacturers (OEMs) of the covered VRF multi-split system

[18] The size standards are listed by NAICS code and industry description and are available at: *www.sba.gov/document/support--table-size-standards* (Last accessed on July 16, 2021).

[19] DOE's Compliance Certification Database is available at: *www.regulations.doe.gov/ccms* (Last accessed May 10, 2021).

[20] The AHRI Directory Database is available at: *www.ahridirectory.org* (Last accessed on May 10, 2021).

equipment. In reviewing the ten OEMs, DOE did not identify any companies that met the SBA criteria for a small entity.

Issue 3: DOE requests comment on its tentative conclusions that no small business OEMs of VRF multi-split systems, that adoption of the prevailing industry standard levels would not result in any significant economic impact, and, accordingly, that the proposed rule would not have significant impacts on a substantial number of small manufacturers.

Therefore, DOE tentatively concludes that this proposed rule, if finalized, would not have "a significant impact on a substantial number of small entities" and that preparation of an IRFA is not warranted. Additional information about this proposal is addressed elsewhere in this document. DOE will transmit this certification and supporting statement of factual basis to the Chief Counsel for Advocacy of the Small Business Administration for review under 5 U.S.C. 605(b).

C. Review Under the Paperwork Reduction Act of 1995

Manufacturers of VRF multi-split systems must certify to DOE that their products comply with any applicable energy conservation standards. In certifying compliance, manufacturers must test their products according to the DOE test procedures for VRF multi-split systems, including any amendments adopted for those test procedures. DOE has established regulations for the certification and recordkeeping requirements for all covered consumer products and commercial equipment, including VRF multi-split systems. *See generally* 10 CFR part 429. The collection-of-information requirement for the certification and recordkeeping is subject to review and approval by OMB under the Paperwork Reduction Act (PRA). This requirement has been approved by OMB under

OMB control number 1910-1400. Public reporting burden for the certification is estimated to average 35 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information.

This NOPR is not proposing changes to the certification and reporting requirements for VRF multi-split system manufacturers.

Notwithstanding any other provision of the law, no person is required to respond to, nor shall any person be subject to a penalty for failure to comply with, a collection of information subject to the requirements of the PRA, unless that collection of information displays a currently valid OMB Control Number.

D. Review Under the National Environmental Policy Act of 1969

DOE is analyzing this proposed regulation in accordance with the National Environmental Policy Act of 1969 (NEPA) and DOE's NEPA implementing regulations (10 CFR part 1021). DOE's regulations include a categorical exclusion for rulemakings that establish energy conservation standards for consumer products or industrial equipment. 10 CFR part 1021, subpart D, appendix B5.1. DOE anticipates that this rulemaking qualifies for categorical exclusion B5.1 because it is a rulemaking that establishes amended energy conservation standards for consumer products or industrial equipment, none of the exceptions identified in categorical exclusion B5.1(b) apply, no extraordinary circumstances exist that require further environmental analysis, and it otherwise meets the requirements for application of a categorical exclusion. *See* 10 CFR 1021.410. DOE will complete its NEPA review before issuing the final rule.

E. Review Under Executive Order 13132

E.O. 13132, "Federalism," 64 FR 43255 (August 10, 1999), imposes certain requirements on Federal agencies formulating and implementing policies or regulations that preempt State law or that have federalism implications. The Executive order requires agencies to examine the constitutional and statutory authority supporting any action that would limit the policymaking discretion of the States and to carefully assess the necessity for such actions. The Executive order also requires agencies to have an accountable process to ensure meaningful and timely input by State and local officials in the development of regulatory policies that have federalism implications. On March 14, 2000, DOE published a statement of policy describing the intergovernmental consultation process it will follow in the development of such regulations. 65 FR 13735. DOE has examined this proposed rule and has tentatively determined that it would not have a substantial direct effect on the States, on the relationship between the national government and the States, or on the distribution of power and responsibilities among the various levels of government. EPCA governs and prescribes Federal preemption of State regulations as to energy conservation for the products that are the subject of this proposed rule. States can petition DOE for exemption from such preemption to the extent, and based on criteria, set forth in EPCA. (42 U.S.C. 6297(d)) Therefore, no further action is required by Executive Order 13132.

F. Review Under Executive Order 12988

Regarding the review of existing regulations and the promulgation of new regulations, section 3(a) of E.O. 12988, "Civil Justice Reform," 61 FR 4729 (Feb. 7, 1996), imposes on Federal agencies the general duty to adhere to the following requirements: (1) eliminate drafting errors and ambiguity; (2) write regulations to minimize litigation; (3) provide a clear legal standard for affected conduct rather than a general standard, and (4) promote simplification and burden reduction. Regarding the

review required by section 3(a), section 3(b) of E.O. 12988 specifically requires that Executive agencies make every reasonable effort to ensure that the regulation: (1) clearly specifies the preemptive effect, if any; (2) clearly specifies any effect on existing Federal law or regulation; (3) provides a clear legal standard for affected conduct while promoting simplification and burden reduction; (4) specifies the retroactive effect, if any; (5) adequately defines key terms, and (6) addresses other important issues affecting clarity and general draftsmanship under any guidelines issued by the Attorney General. Section 3(c) of Executive Order 12988 requires executive agencies to review regulations in light of applicable standards in sections 3(a) and 3(b) to determine whether they are met or it is unreasonable to meet one or more of them. DOE has completed the required review and determined that, to the extent permitted by law, this proposed rule meets the relevant standards of E.O. 12988.

G. Review Under the Unfunded Mandates Reform Act of 1995

Title II of the Unfunded Mandates Reform Act of 1995 (UMRA) requires each Federal agency to assess the effects of Federal regulatory actions on State, local, and Tribal governments and the private sector. Pub. L. 104-4, section 201 (codified at 2 U.S.C. 1531). For a proposed regulatory action likely to result in a rule that may cause the expenditure by State, local, and Tribal governments, in the aggregate, or by the private sector of $100 million or more in any one year (adjusted annually for inflation), section 202 of UMRA requires a Federal agency to publish a written statement that estimates the resulting costs, benefits, and other effects on the national economy. (2 U.S.C. 1532(a), (b)) The UMRA also requires a Federal agency to develop an effective process to permit timely input by elected officers of State, local, and Tribal governments on a proposed "significant intergovernmental mandate," and requires an agency plan for giving notice and opportunity for timely input to potentially affected small governments

before establishing any requirements that might significantly or uniquely affect them. On March 18, 1997, DOE published a statement of policy on its process for intergovernmental consultation under UMRA. 62 FR 12820. DOE's policy statement is also available at *https://energy.gov/sites/prod/files/gcprod/documents/umra_97.pdf*.

DOE examined this proposed rule according to UMRA and its statement of policy and determined that this proposed rule contains neither a Federal intergovernmental mandate, nor a mandate that may result in the expenditures of $100 million or more in any one year. As a result, the analytical requirements of UMRA do not apply.

H. Review Under the Treasury and General Government Appropriations Act, 1999

Section 654 of the Treasury and General Government Appropriations Act, 1999 (Pub. L. 105-277) requires Federal agencies to issue a Family Policymaking Assessment for any rule that may affect family well-being. This proposed rule would not have any impact on the autonomy or integrity of the family as an institution. Accordingly, DOE has concluded that it is not necessary to prepare a Family Policymaking Assessment.

I. Review Under Executive Order 12630

Pursuant to E.O. 12630, "Governmental Actions and Interference with Constitutionally Protected Property Rights," 53 FR 8859 (March 18, 1988), DOE has determined that this proposed rule would not result in any takings that might require compensation under the Fifth Amendment to the U.S. Constitution.

J. Review Under the Treasury and General Government Appropriations Act, 2001

Section 515 of the Treasury and General Government Appropriations Act, 2001 (44 U.S.C. 3516 note) provides for Federal agencies to review most disseminations of information to the public under information quality guidelines established by each agency

pursuant to general guidelines issued by OMB. OMB's guidelines were published at 67 FR 8452 (Feb. 22, 2002), and DOE's guidelines were published at 67 FR 62446 (Oct. 7, 2002). Pursuant to OMB Memorandum M-19-15, "Improving Implementation of the Information Quality Act" (April 24, 2019), DOE published updated guidelines which are available at: *https://www.energy.gov/sites/prod/files/2019/12/f70/DOE%20Final%20Updated%20IQA%20Guidelines%20Dec%202019.pdf*. DOE has reviewed this NOPR under the OMB and DOE guidelines and has concluded that it is consistent with applicable policies in those guidelines.

K. Review Under Executive Order 13211

E.O. 13211, "Actions Concerning Regulations That Significantly Affect Energy Supply, Distribution, or Use," 66 FR 28355 (May 22, 2001), requires Federal agencies to prepare and submit to OIRA at OMB, a Statement of Energy Effects for any proposed significant energy action. A "significant energy action" is defined as any action by an agency that promulgates or is expected to lead to promulgation of a final rule, and that: (1) is a significant regulatory action under Executive Order 12866, or any successor order; and (2) is likely to have a significant adverse effect on the supply, distribution, or use of energy, or (3) is designated by the Administrator of OIRA as a significant energy action. For any proposed significant energy action, the agency must give a detailed statement of any adverse effects on energy supply, distribution, or use should the proposal be implemented, and of reasonable alternatives to the action and their expected benefits on energy supply, distribution, and use.

DOE has tentatively concluded that this regulatory action, which proposes amended energy conservation standards for VRF multi-split systems, is not a significant

energy action because the proposed standards are not likely to have a significant adverse effect on the supply, distribution, or use of energy, nor has it been designated as such by the Administrator at OIRA. Accordingly, DOE has not prepared a Statement of Energy Effects on this proposed rule.

L. Review Under the Information Quality Bulletin for Peer Review

On December 16, 2004, OMB, in consultation with the Office of Science and Technology Policy (OSTP), issued its Final Information Quality Bulletin for Peer Review ("the Bulletin"). 70 FR 2664 (Jan. 14, 2005). The Bulletin establishes that certain scientific information shall be peer reviewed by qualified specialists before it is disseminated by the Federal Government, including influential scientific information related to agency regulatory actions. The purpose of the bulletin is to enhance the quality and credibility of the Government's scientific information. Under the Bulletin, the energy conservation standards rulemaking analyses are "influential scientific information," which the Bulletin defines as "scientific information the agency reasonably can determine will have, or does have, a clear and substantial impact on important public policies or private sector decisions." 70 FR 2664, 2667 (Jan. 14, 2005).

In response to OMB's Bulletin, DOE conducted formal peer reviews of the energy conservation standards development process and the analyses that are typically used and has prepared a report describing that peer review.[21] Generation of this report involved a rigorous, formal, and documented evaluation using objective criteria and qualified and independent reviewers to make a judgment as to the technical/scientific/business merit, the actual or anticipated results, and the productivity

[21] The 2007 "Energy Conservation Standards Rulemaking Peer Review Report" is available at the following website: *https://energy.gov/eere/buildings/downloads/energy-conservation-standards-rulemaking-peer-review-report-0*.

and management effectiveness of programs and/or projects. DOE has determined that the peer-reviewed analytical process continues to reflect current practice, and the Department followed that process for developing energy conservation standards in the case of the present rulemaking.

VII. Public Participation

A. Participation at the Webinar

The time and date of the webinar meeting are listed in the **DATES** section at the beginning of this document. Webinar registration information, participant instructions, and information about the capabilities available to webinar participants will be published on DOE's website: *www.energy.gov/eere/buildings/public-meetings-and-comment-deadlines.* Participants are responsible for ensuring their systems are compatible with the webinar software.

B. Procedure for Submitting Prepared General Statements for Distribution

Any person who has an interest in the topics addressed in this proposed rule, or who is representative of a group or class of persons that has an interest in these issues, may request an opportunity to make an oral presentation at the public meeting webinar. Such persons may submit requests to speak via email to the Appliance and Equipment Standards Program at: *ApplianceStandardsQuestions@ee.doe.gov*. Persons who wish to speak should include with their request a computer file in WordPerfect, Microsoft Word, PDF, or text (ASCII) file format that briefly describes the nature of their interest in this rulemaking and the topics they wish to discuss. Such persons should also provide a daytime telephone number where they can be reached.

Persons requesting to speak should briefly describe the nature of their interest in this rulemaking and provide a telephone number for contact. DOE requests persons selected to make an oral presentation to submit an advance copy of their statements at least two weeks before the public meeting webinar. At its discretion, DOE may permit persons who cannot supply an advance copy of their statement to participate, if those persons have made advance alternative arrangements with the Building Technologies Office. As necessary, requests to give an oral presentation should ask for such alternative arrangements.

C. Conduct of the Public Meeting Webinar

DOE will designate a DOE official to preside at the webinar/public meeting and may also use a professional facilitator to aid discussion. The meeting will not be a judicial or evidentiary-type public hearing, but DOE will conduct it in accordance with section 336 of EPCA (42 U.S.C. 6306). A court reporter will be present to record the proceedings and prepare a transcript. DOE reserves the right to schedule the order of presentations and to establish the procedures governing the conduct of the webinar/public meeting. There shall not be discussion of proprietary information, costs or prices, market share, or other commercial matters regulated by U.S. anti-trust laws. After the webinar/public meeting and until the end of the comment period, interested parties may submit further comments on the proceedings and any aspect of the proposed rulemaking.

The public meeting webinar will be conducted in an informal, conference style. DOE will present a general overview of the topics addressed in this proposed rulemaking, allow time for prepared general statements by participants, and encourage all interested parties to share their views on issues affecting this proposed rulemaking. Each

participant will be allowed to make a general statement (within time limits determined by DOE), before the discussion of specific topics. DOE will allow, as time permits, other participants to comment briefly on any general statements.

At the end of all prepared statements on a topic, DOE will permit participants to clarify their statements briefly and comment on statements made by others. Participants should be prepared to answer questions by DOE and by other participants concerning these issues. DOE representatives may also ask questions of participants concerning other matters relevant to this rulemaking. The official conducting the public meeting webinar will accept additional comments or questions from those attending, as time permits. The presiding official will announce any further procedural rules or modification of the above procedures that may be needed for the proper conduct of the public meeting webinar.

A transcript of the webinar/public meeting will be included in the docket, which can be viewed as described in the *Docket* section at the beginning of this NOPR. In addition, any person may buy a copy of the transcript from the transcribing reporter.

D. Submission of Comments

DOE will accept comments, data, and information regarding this proposed rule before or after the public meeting webinar, but no later than the date provided in the **DATES** section at the beginning of this proposed rule. Interested parties may submit comments, data, and other information using any of the methods described in the **ADDRESSES** section at the beginning of this document.

Submitting comments via www.regulations.gov. The *www.regulations.gov* webpage will require you to provide your name and contact information. Your contact information will be viewable to DOE Building Technologies staff only. Your contact information will not be publicly viewable except for your first and last names, organization name (if any), and submitter representative name (if any). If your comment is not processed properly because of technical difficulties, DOE will use this information to contact you. If DOE cannot read your comment due to technical difficulties and cannot contact you for clarification, DOE may not be able to consider your comment.

However, your contact information will be publicly viewable if you include it in the comment itself or in any documents attached to your comment. Any information that you do not want to be publicly viewable should not be included in your comment, nor in any document attached to your comment. If this instruction is followed, persons viewing comments will see only first and last names, organization names, correspondence containing comments, and any documents submitted with the comments.

Do not submit to *www.regulations.gov* information for which disclosure is restricted by statute, such as trade secrets and commercial or financial information (hereinafter referred to as Confidential Business Information (CBI)). Comments submitted through *www.regulations.gov* cannot be claimed as CBI. Comments received through the website will waive any CBI claims for the information submitted. For information on submitting CBI, see the Confidential Business Information section.

DOE processes submissions made through *www.regulations.gov* before posting. Normally, comments will be posted within a few days of being submitted. However, if large volumes of comments are being processed simultaneously, your comment may not

be viewable for up to several weeks. Please keep the comment tracking number that *www.regulations.gov* provides after you have successfully uploaded your comment.

Submitting comments via email. Comments and documents submitted via email also will be posted to *www.regulations.gov*. If you do not want your personal contact information to be publicly viewable, do not include it in your comment or any accompanying documents. Instead, provide your contact information in a cover letter. Include your first and last names, email address, telephone number, and optional mailing address. The cover letter will not be publicly viewable as long as it does not include any comments.

Include contact information each time you submit comments, data, documents, and other information to DOE. No telefacsimiles (faxes) will be accepted.

Comments, data, and other information submitted to DOE electronically should be provided in PDF (preferred), Microsoft Word or Excel, WordPerfect, or text (ASCII) file format. Provide documents that are not secured, that are written in English, and that are free of any defects or viruses. Documents should not contain special characters or any form of encryption, and, if possible, they should carry the electronic signature of the author.

Campaign form letters. Please submit campaign form letters by the originating organization in batches of between 50 to 500 form letters per PDF or as one form letter with a list of supporters' names compiled into one or more PDFs. This reduces comment processing and posting time.

Confidential Business Information. Pursuant to 10 CFR 1004.11, any person submitting information that he or she believes to be confidential and exempt by law from public disclosure should submit via email two well-marked copies: one copy of the document marked "confidential" including all the information believed to be confidential, and one copy of the document marked "non-confidential" with the information believed to be confidential deleted. DOE will make its own determination about the confidential status of the information and treat it according to its determination.

It is DOE's policy that all comments may be included in the public docket, without change and as received, including any personal information provided in the comments (except information deemed to be exempt from public disclosure).

E. Issues on Which DOE Seeks Comment

Although DOE welcomes comments on any aspect of this proposal, DOE is particularly interested in receiving comments and views of interested parties concerning the following issues:

Issue 1: DOE requests comment on its crosswalk analysis methodology and crosswalk results.

Issue 2: DOE requests comment on its proposal to align equipment classes for VRF multi-split systems with the structure in ASHRAE Standard 90.1-2016, with additional clarification for heating type.

Issue 3: DOE requests comment on its tentative conclusions that there are no small businesses that are OEMs of VRF multi-split systems, that adoption of the prevailing industry standard levels would not result in any significant economic impact,

and accordingly, that the proposed rule would not have significant impacts on a substantial number of small manufacturers.

Additionally, DOE welcomes comments on other issues relevant to the conduct of this rulemaking that may not specifically be identified in this document.

VIII. Approval of the Office of the Secretary

The Secretary of Energy has approved publication of this notice of proposed rulemaking and request for comment.

List of Subjects in 10 CFR Part 431

Administrative practice and procedure, Confidential business information, Energy conservation, Reporting and recordkeeping requirements.

Signing Authority

This document of the Department of Energy was signed on February 9, 2022, by Kelly J. Speakes-Backman, Principal Deputy Assistant Secretary for Energy Efficiency and Renewable Energy, pursuant to delegated authority from the Secretary of Energy. That document with the original signature and date is maintained by DOE. For administrative purposes only, and in compliance with requirements of the Office of the Federal Register, the undersigned DOE Federal Register Liaison Officer has been authorized to sign and submit the document in electronic format for publication, as an official document of the Department of Energy. This administrative process in no way alters the legal effect of this document upon publication in the *Federal Register*.

Signed in Washington, DC, on February 17, 2022.

Treena V. Garrett
Federal Register Liaison Officer,
U.S. Department of Energy

For the reasons set forth in the preamble, DOE proposes to amend part 431 of title 10 of the Code of Federal Regulations, as set forth below:

PART 431 – ENERGY EFFICIENCY PROGRAM FOR CERTAIN COMMERCIAL AND INDUSTRIAL EQUIPMENT

1. The authority citation for part 431 continues to read as follows:

Authority: 42 U.S.C 6291-6317; 28 U.S.C 2461 note.

2. Section 431.97 is amended by:

a. Revising paragraph (f) and Table 13; and

b. Adding Table 14.

The revisions and addition read as follows:

§431.97 Energy efficiency standards and their compliance dates.

* * * * *

(f) (1) Each variable refrigerant flow air conditioner or heat pump manufactured on or after the compliance date listed in Table 13 of this section and prior to January 1, 2024, must meet the applicable minimum energy efficiency standard level(s) set forth in Table 13 of this section.

TABLE 13 TO PARAGRAPH (F)(1)—MINIMUM EFFICIENCY STANDARDS FOR VARIABLE REFRIGERANT FLOW MULTI-SPLIT AIR CONDITIONERS AND HEAT PUMPS

Equipment type	Cooling capacity	Heating type[1]	Efficiency level	Compliance date: Products manufactured on and after . . .
VRF Multi-Split Air Conditioners (Air-Cooled)	<65,000 Btu/h	All	13.0 SEER	June 16, 2008.
	≥65,000 Btu/h and <135,000 Btu/h	No Heating or Electric Resistance Heating	11.2 EER	January 1, 2010.
		All Other Types of Heating	11.0 EER	January 1, 2010.
	≥135,000 Btu/h and <240,000 Btu/h	No Heating or Electric Resistance Heating	11.0 EER	January 1, 2010.
		All Other Types of Heating	10.8 EER	January 1, 2010.
	≥240,000 Btu/h and <760,000 Btu/h	No Heating or Electric Resistance Heating	10.0 EER	January 1, 2010.
		All Other Types of Heating	9.8 EER	January 1, 2010.
VRF Multi-Split Heat Pumps (Air-Cooled)	<65,000 Btu/h	All	13.0 SEER 7.7 HSPF	June 16, 2008.
	≥65,000 Btu/h and <135,000 Btu/h	No Heating or Electric Resistance Heating	11.0 EER 3.3 COP	January 1, 2010.
		All Other Types of Heating	10.8 EER 3.3 COP	January 1, 2010.
	≥135,000 Btu/h and <240,000 Btu/h	No Heating or Electric Resistance Heating	10.6 EER 3.2 COP	January 1, 2010.
		All Other Types of Heating	10.4 EER 3.2 COP	January 1, 2010.
	≥240,000 Btu/h and <760,000 Btu/h	No Heating or Electric Resistance Heating	9.5 EER 3.2 COP	January 1, 2010.

		All Other Types of Heating	9.3 EER 3.2 COP	January 1, 2010.
VRF Multi-Split Heat Pumps (Water-Source)	<17,000 Btu/h	Without Heat Recovery	12.0 EER 4.2 COP	October 29, 2012. October 29, 2003.
		With Heat Recovery	11.8 EER 4.2 COP	October 29, 2012. October 29, 2003.
	≥17,000 Btu/h and <65,000 Btu/h	All	12.0 EER 4.2 COP	October 29, 2003.
	≥65,000 Btu/h and <135,000 Btu/h	All	12.0 EER 4.2 COP	October 29, 2003.
	≥135,000 Btu/h and <760,000 Btu/h	Without Heat Recovery	10.0 EER 3.9 COP	October 29, 2013.
		With Heat Recovery	9.8 EER 3.9 COP	October 29, 2013.

[1] VRF multi-split heat pumps (air-cooled) with heat recovery fall under the category of "All Other Types of Heating" unless they also have electric resistance heating, in which case it falls under the category for "No Heating or Electric Resistance Heating."

(2) Each variable refrigerant flow air conditioner or heat pump (except air-cooled systems with cooling capacity less than 65,000 Btu/h) manufactured on or after January 1, 2024, must meet the applicable minimum energy efficiency standard level(s) set forth in Table 14 of this section.

TABLE 14 TO PARAGRAPH (F)(2)—UPDATED MINIMUM EFFICIENCY STANDARDS FOR VARIABLE REFRIGERANT FLOW MULTI-SPLIT AIR CONDITIONERS AND HEAT PUMPS

Equipment Type	Size Category	Heating Type	Minimum Efficiency
VRF Multi-Split Air Conditioners (Air-Cooled)	≥65,000 and <135,000 Btu/h	All	15.5 IEER
	≥135,000 and <240,000 Btu/h	All	14.9 IEER

	≥240,000 Btu/h and <760,000 Btu/h	All	13.9 IEER
VRF Multi-Split Heat Pumps (Air-Cooled)	≥65,000 and <135,000 Btu/h	Heat Pump without Heat Recovery	14.6 IEER 3.3 COP
		Heat Pump with Heat Recovery	14.4 IEER 3.3 COP
	≥135,000 and <240,000 Btu/h	Heat Pump without Heat Recovery	13.9 IEER 3.2 COP
		Heat Pump with Heat Recovery	13.7 IEER 3.2 COP
	≥240,000 Btu/h and <760,000 btu/h	Heat Pump without Heat Recovery	12.7 IEER 3.2 COP
		Heat Pump with Heat Recovery	12.5 IEER 3.2 COP
VRF Multi-Split Heat Pumps (Water-Source)	<65,000 Btu/h	Heat Pump without Heat Recovery	16.0 IEER 4.3 COP
		Heat Pump with Heat Recovery	15.8 IEER 4.3 COP
	≥65,000 and <135,000 Btu/h	Heat Pump without Heat Recovery	16.0 IEER 4.3 COP
		Heat Pump with Heat Recovery	15.8 IEER 4.3 COP
	≥135,000 and <240,000 Btu/h	Heat Pump without Heat Recovery	14.0 IEER 4.0 COP
		Heat Pump with Heat Recovery	13.8 IEER 4.0 COP
	≥240,000 Btu/h and <760,000 Btu/h	Heat Pump without Heat Recovery	12.0 IEER 3.9 COP
		Heat Pump with Heat Recovery	11.8 IEER 3.9 COP

[FR Doc. 2022-03836 Filed: 2/28/2022 8:45 am; Publication Date: 3/1/2022]